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A MONTHLY REVIEW OF SURGICAL SCIENCE AND PRACTICE

EDITED BY
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ORIGINAL MEMOIRS.

THE END RESULTS AFTER TOTAL EXCISION OF THE SCAPULA FOR SARCOMA.*

WITH STATISTICAL TABLES

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SOME thirty or more years ago, one of the most distinguished of English surgeons, the late Sir John Eric Ericsen, is credited with saying that we had practically reached finality in surgery—that there were no new fields to conquer, although of course improvements in technic, and therefore better results, were doubtless obtainable. Let us look back. What is left of the old surgery? Has not cerebral, gastric, hepatic, intestinal, pulmonary, and cardiac surgery been born and grown to lusty maturity since then? Are we assured against falling into error similar to that of Sir John Ericsen? Certainly not; and it seems to me that the bulk of the profession is tending to perpetuate certain errors by keeping their eyes too exclusively fixed upon improvements in mere technic, which really determines much of our miscalled modern success. Our wonderful immunity against wound infection, and our control of many of the factors making for dangerous shock, seems to me to be leading us to perform numberless operations upon the plea that if not fatal from hemorrhage and shock—mostly preventable—operative recovery is sure to occur; as if satisfactory "end results" were not more important than temporary recovery—a somewhat doubtful blessing for the victims of malignant disease.

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* Presidential address delivered before the American Surgical Association, Philadelphia, June 3, 1909.

Do we not compile our statistics rather to demonstrate the success of our technic, so far as the immediate risk to life is concerned, rather than to show by the "end results," *i.e.,* what benefit has accrued to the patient? Would it not be well to lay to heart some advice of Sir W. H. Bennett's which I will quote. "It is well that we should beware lest a single predominant factor should be allowed to lead to our regarding, through a small tube only, a subject the horizon of which is absolutely unlimited. It has been said that the basis of surgery is handicraft, and this, in a sense, is true; but surely it is truth only half told," for "lying behind certain issues" to which I have referred, "is a far greater thing—the knowledge of when to apply that craftmanship of which everyone who now aspires to the practice of surgery should make himself a master. Nothing that has happened in the improvements connected with the practice of our art justifies, so far as I know, the modification by one iota of the edict of the great surgeon, who before advancing science had robbed operations of most of their horrors, said: "The all-important thing is not the skill with which you use the knife, but the judgment with which you discern whether its employment is necessary or not." Substituting the word "technic" for "handicraft," and "is worth while" for "is necessary," this quotation epitomises the object of my address.

To appraise correctly the propriety of any operation we must not only ascertain the immediate mortality, but the *ultimate mortality,* from failure to really cure, before we subject our patients to useless risks. At least, we should be able to say that a certain number, however small, are cured, or that the interval before recurrence is likely to be long. No one recognizes more readily than I do how unreliable statistics are; but if with monotonous regularity the "end result " is failure, at least we can be assured that this is vastly more likely to attend our future efforts than success, without any nice calculation of percentages,—and we shall cease to be self deceivers and blind leaders of our blinder but confiding patients.

In all business it is necessary to take stock from time to time, in order to ascertain whether our increasing income is a genuine return upon our invested capital, or whether we may not have impaired this and are gradually becoming bankrupt. So also in our profession it is wise to " take stock," as it were, to determine whether we really have made all the progress we claim, or whether, perchance, we have not diminished our capital of apparently well-grounded confidence, until the inevitable crash comes, revealing the true state of affairs, with its subsequent long-continued distrust of even conservative and genuine progress. This is well illustrated by the diametrically opposite advice given for the operative treatment of head injuries, during the eighteenth and nineteenth centuries. Should we find that real progress has been made, we can continue our practices; if partial advance alone has been secured, we must strive to render our success more complete; if real failure be the verdict of careful study, we must at once abandon that which has proved a broken reed, and start afresh in some new direction. Monumental conceit can alone oppose such periodic investigations, but those are unlikely to be welcomed with open arms who suggest the possibility that all which we now advocate and practice may not be good.

Following the example of one of my illustrious predecessors in this Presidential Chair, the late D. Hayes Agnew, instead of attempting to address you on some general subject. I shall strive to add my small contribution to the sum of more exact surgical knowledge. I have selected for investigation, total excision of the scapula for primary malignant disease. This of course practically means some form of sarcoma, since true carcinoma cannot be primary in bone. I am influenced in my choice because this is strictly a conservative operation for malignant disease of the bone, and because the local extirpation of all the neoplasm presents apparently most favorable conditions. Moreover, while not frequently performed, a sufficient number of cases are at everyone's disposal to guide us in deciding the following questions:

What are the probabilities as to operative death? Is there a material improvement in the numbers of the immediate survivals of the operations owing to our modern means for conserving blood? What are the chances for local recurrence, and are they early or late? Are early visceral metastases or recidives common? When operative recovery ensues, to what is the later death usually due? Is life much prolonged, and how much relief is effected by the operation? Can excision of the scapula be considered a curative operation, and if so, can this frequently be affirmed?

I shall endeavor to briefly settle for you these questions by the results of a study of all the recorded cases accessible to me in medical literature, and all unpublished cases with which the Fellows, and others have kindly supplied me by correspondence. A complete table of all unquestioned cases is appended, to enable the Fellows to review my conclusions if they so desire, and I must beg that they will judge of their correctness by glancing at the Tables (pages 8 to 17) as I read, these really constituting the body of my address.

I do not deny the possibility—indeed, the probability—that I have not secured reports of all total excisions of the scapula for malignant disease, and possibly more favorable results might thus be revealed if additional cases were unearthed, but after the exhaustive efforts I have made, I am convinced that no material change would be made in my conclusions.

A few words are requisite to explain the methods employed in the compilation of these tables, which differ widely from all their predecessors. Nothing so strongly impresses the conscientious student as the extraordinary inaccuracy of the tables purporting to be those of complete extirpations of the scapula. Many cases were really partial removals, or, sometimes, indeed complete removals, but done in two stages.

this latter method being a decidedly less dangerous operative procedure than complete removal at one sitting, although favoring local recidives and visceral metastases. Still further, cases are often admitted where portions of the clavicle or even the head of the humerus have been involved by the neoplasm and required removal; it is manifestly improper to include such cases in statistics purporting to be operations for disease restricted to the scapula, and is misleading as to the results of removal of the scapula alone.

A few cases have been included in my statistics where portions of the healthy clavicle,or even the head of the humerus have been removed. Such sacrifice of healthy bone tissue was to shorten the operation, to enable inadequate soft tissue flaps to cover the bones, or to mould the shoulder into better shape, not because of any trouble in the bones. Per contra in two instances in my tables small portions of the tip of the coracoid were left to facilitate operation, but in neither instance did these serve as the starting points for recidives, so far as is known (see cases of Gerster, No. 50, and of Bastiennelli, No. 59). It has seemed better to include these cases in the body of my statistics rather than to place them in the doubtful class, upon purely technical grounds.

In such cases it was thought that any increased risk of pyogenic or neoplastic infection of the cut osseous surfaces, or additional oozing, was more than counterbalanced by the greater certainty that no macroscopic diseased tissue was overlooked, and that the rapidity of the operation secured by cutting through, instead of disarticulating the clavicle or dissecting out the coracoid process, lessened both hemorrhage and shock. All such cases promptly recovered, thus showing that no additional operative risk was incurred.

Again, the most careful search throughout the whole domain of medical literature by myself and others, has failed to reveal any reliable information concerning certain cases found in nearly all tables. Their existence is not denied, only the propriety of quoting them is severely questioned. Even a case, which research showed was a removal of the scapula *after* death, has been included by Karl Heldrich in his dissertation entitled, "Totale Resection der Scapula," München, 1903.

I can only attribute these blunders to the childlike confidence reposed by some in the accuracy of the headings of articles, inducing them to confine their researches solely to a perusal of the titles of reported cases, when a most cursory glance over the text would have shown the misleading character of these. In some few, the evidence advanced to prove that the disease was primary in, and confined to, the scapula has proved fallacious, a careful scrutiny of the history demonstrating that the neoplasm originated in contiguous muscles, this form of sarcoma being claimed by Butlin to be especially virulent as compared with bone sarcoma; these cases have been excluded or placed in the doubtful class. Contrary to the common practice, all cases where the microscopic picture and the subsequent clinical course proved that the growth was a pure enchondroma have been rigidly excluded from my tables. With still greater propriety, excisions for tubercular or pyogenic osteomyelitis and its consequences, are omitted, because in such cases if operative convalescence is secured, cure is effected, which certainly cannot be affirmed after operations for malignant disease. The inadequacy of the description of the microscopic appearances of one case of cyst of the bone following trauma, where no proper evidence of malignancy was supplied, led me to place this case in the "doubtful class."

Finally, from the later published reports, or by correspondence, some cases have been transferred from the cured class to the death column. From such researches I think that I am amply warranted in placing the question mark after cases which have made operative recoveries, but whose subsequent histories have extended only over a few months, and in some instances only a few weeks. The demonstrated inadequacy of the three years rule has led to its total disregard in this address, because a slavish and ignorant adherence to this artificial rule has led to many unwarranted statements upon which has been founded erroneous practice. Under this rule recovery has been claimed while the reporter states that a late metastasis proved incapable of being radically treated.

All the statistics of the past, French, German, American, are absolutely misleading as to the operative mortality and end results of total excision of the scapula for primary sarcoma.

Although I have added twenty-two cases to those published in 1900 in Buchanan's tables, after a careful study of the literature by myself and two competent linguists, I have felt compelled to eliminate a number of cases, so that the total is slightly below that reported by Buchanan, for total extirpations, and upon which surgeons have relied since its publication in 1900. I wish here to acknowledge my indebtedness to this author both for his valuable tables and the information supplied me by his personal communications. I have also added two new cases to the second table comprising those where more than the scapula was involved in the malignant process.

A study of the 65 cases of malignant diseases tabulated, where the scapula alone seemed involved, has led to the surprising discovery that only one case is nearly certainly cured—MacDonald's, No. 39. Buchanan's case, No. 33, with hopeless metastases five years after excision of the scapula, should serve as a warning not to be over-sanguine. The following were probably cures, although in none had they been observed as long as Buchanan's. Case No. 4 of Syme's was well "several years" after the operation on the scapula, although this had been preceded by removal of the humeral head for a supposedly benign condition, and its admission to my list is perhaps of doubtful propriety.

Case No. 29 (Phelps) was believed to be well four years after amputation of the arm for recurrence. Cases 16, 38, 39, 46, 54, 60 and 61, were only followed for under four years. Accordingly we have one practically certain cure, and six probably cured, but one of these required a secondary operation and all may have relapsed later. Set against these

TABLE I.—END RESULTS AFTER TOTAL

No.	Operator	Date of operation	Sex Age	Condition for which operation was done	Operative results
1	J. Syme, Edinburgh............ Buchanan's list, No. 2	Oct. 1, 1856	F. 70 yrs.	Cystosarcoma	Recovery
2	F. von Esmarch, Kiel.......... Buchanan's list, No. 6	May 9, 1859	M. 33 yrs.	Sarcoma	Recovery
3	A. Hammer, St. Louis.......... Buchanan's list, No. 7	Oct., 1860	F. 18 yrs.	"Malignant growth" (Sarcoma)	Recovery
4	J. Syme, Edinburgh............ Buchanan's list, No. 8	Nov. 13, 1862	M. 45 yrs.	"Malignant growth" (Sarcoma)	Recovery
5	M. Michaux, Louvain........... Buchanan's list, No. 9	Nov. 24, 1864	M. 15 yrs.	"Encephaloma" (Sarcoma)	Recovery
6	S. Rogers, New York........... Buchanan's list, No. 11	Dec. 12, 1867	F. 7 yrs.	Carcinoma (Sarcoma)	Recovery
7	G. Pollock, London............ Buchanan's list, No. 13	Sept. 30, 1869	M. 47 yrs.	"Vascular growth" (Sarcoma)	Death
8	C. Steele, Bristol............... Buchanan's list, No. 14	April 18, 1871	F. 8 yrs.	Encephaloid (Sarcoma)	Recovery
9	K. King, Hull................. Buchanan's list, No. 15	June 17, 1871	F. 8 yrs.	Carcinoma (Sarcoma)	Recovery
10	J. Spence, Edinburgh........... Buchanan's list, No. 17	Feb. 21, 1872	M. 66 yrs.	"Malignant growth" (Sarcoma)	Recovery
11	R. Schnieder, Kõnigsburg....... Buchanan's list, No. 19	Dec. 3, 1873	M. 6 yrs.	Sarcoma	Recovery
12	Wm. MacCormac, London Buchanan's list, No. 21	May 10, 1876	F. 29 yrs.	"Myxochondroma" Myxochondrosarcoma (?)	Recovery

EXCISION OF THE SCAPULA FOR SARCOMA

Later history	End results	Remarks	Reference
No recurrence during two months, patient survived	Died in 2 m.	Exhaustion and old age, yet no adequate cause for exhaustion is given. Were there metastases in the organs essential to life?	Medico-Chirurgical Trans., London, 1857, vol. xl, p. 507.
Recurrence early	Died in 6 m.	Part of clavicle removed—apparently healthy—to facilitate operation	Archiv f. klin. Chirurg., 1863, vol. iv, p. 584
Recurrence early	Died 10 m. after operation	Three-fourths of inch of clavicle removed to facilitate operation	St. Louis Med. Rep., 1866, vol. i, p. 7.
No recurrence "several years later"	Recovery	Head of humerus had been previously removed for chondroma(?) It is somewhat questionable whether this case should be classed as an excision of the scapula in view of the previous operation	Syme, Excision of the Scapula, Edinburgh, 1864.
Rapid development of mediastinal growth	Death in 10 m.	....	Gaz. Méd. de Paris, 1866, p. 313.
Rapid recurrence	Death in 6 m.	Carcinoma not being primary in bone, the growth must have been sarcoma	Amer. Journal Med. Sciences, 1868, vol. lvi, p. 359
Bronchopneumonia aggravated by the chloroform	Died on 5th d.	Part of clavicle removed because thought to be "slightly eroded." Were not the apparent bronchitic symptoms probably due to undetected pulmonary metastases giving rise to active symptoms from the irritant effects of chloroform?	St. George's Hospital Reports, 1869, vol. iv, p. 233.
Recurrence in less than seven weeks; this was removed but was followed by another in two weeks, which proved inoperable	Died middle of Sept. 1871, about 5 m.	Secondary operation at 7 weeks followed by hopeless recurrence	Brit. Med. Journal, 1871, vol. ii, p. 430.
No recurrence 2 years later	Recovery(?)	Too early for definite results, as many cases die from recurrence or metastasis much later	Liverpool and Manchester Med. and Surgical Reports, 1874.
(?)	Died in 6 m.	Careful scrutiny of the history shows that bronchitic(?) symptoms existed before operation, continued with varying intensity during so-called "convalescence," culminating in death from "capillary bronchitis;" no post-mortem. The whole pulmonary condition was almost certainly due to lung metastases preceding operation	Dublin Journal of the Medical Sciences, 1873, vol. lv, p. 508.
Generalization	Died in 4½ m.	Uninvolved portion of clavicle removed to facilitate operation	Berlin. klin Wochensch., 187, vol. xi, p. 377
Recurrence	Died Nov. 12, 1876, 6 m. after operation	Clavicle divided just internal to coracoid process for convenience. So-called myxochondromata contain genuine sarcomatous tissue if all portions of the growth are carefully examined in almost every instance	St. Thomas's Hospital Reports, 1876, vol. vii, p. 307.

TABLE I.—END RESULTS AFTER TOTAL EXCISION

No.	Operator	Date of operation	Sex Age	Condition for which operation was done	Operative results
13	J. Spence, Edinburgh Buchanan's list, No. 25	1877	.. ....	"Tumor"	Death
14	G. A. Peters Buchanan's list, No. 26	Jan. 11, 1878	M. 42 yrs.	Carcinoma (Sarcoma)	Recovery
15	F. A. Nixon Buchanan's list, No. 28	Nov., 1881	M. 13 yrs.	Sarcoma	Recovery
16	A. Roth, Cagliari Buchanan's list, No. 29	Jan. 14, 1884	M. 33 yrs.	Myxosarcoma	Recovery
17	Geo. W. Gay, Boston de Nancrède	Feb. 1, 1884	M. 23 yrs.	Sarcoma	Recovery
18	Mr. Ellison Buchanan's list, No. 30	July 7, 1884	M. 13 yrs.	Sarcoma	Recovery
19	Lannelongue Buchanan's list, No. 33	Mar. 5, 1885	M. 34 yrs.	Chondrosarcoma	Death
20	J. H. Brinton Buchanan's list, No. 34	Oct. 3, 1885	F. 11 yrs.	Sarcoma	Death
21	H. Trendelenburg, Bonn Buchanan's list, No. 37	Nov. 16, 1886	M. 42 yrs.	Sarcoma	Recovery
22	T. F. Chavasse, Birmingham Buchanan's list, No. 41	Feb., 1888	F. 8 yrs.	Sarcoma	Death
23	P. Sendler, Magdeburg Buchanan's list, No. 43	May 2, 1888	F. 23 yrs.	Sarcoma	Recovery
24	J. Van der Hoeven, Jr. Buchanan's list, No. 44	Mar. 7, 1889	M. 4½ yrs.	Sarcoma	Recovery
25	M. Perier Buchanan's list, No. 45	Oct. 14, 1889	M. 55 yrs.	Sarcoma	Recovery
26	Putti Buchanan's list, No. 46	1889	M. 45 yrs.	Sarcoma	Recovery
27	J. Israel, Berlin de Nancrède	July 6, 1890	M. 38 yrs.	Sarcoma	Recovery
28	Hadra, Erlangen Buchanan's list, No. 48	Jan. 13, 1891	M. 59 yrs.	Sarcoma	Recovery
29	A. M. Phelps, New York Buchanan's list, No. 49	Nov., 1891	M. 42 yrs.	Fibroma by pathologists. Because of recurrence, growth was evidently fibrosarcoma	Recovery
30	Putti Buchanan's list, No. 50	1891	....	Sarcoma	Recovery
31	W. H. A. Jacobson, London Buchanan's list, No. 51	March, 1892	F. Adult	Sarcoma	Recovery
32	M. Folet of Lille Buchanan's list, No. 53	April 14, 1893	F. 19 yrs.	Sarcoma	Recovery

OF THE SCAPULA FOR SARCOMA—*Continued*

Later history	End results	Remarks	Reference
....	Died	Clavicle divided near acromial end to facilitate operation. Nothing beyond statement that operation was done and result	Lectures on Surgery, 3rd Ed., vol. ii, p. 1107.
No recurrence at last re-report at the end of 3 months	Recovery(?)	Too early for definite end results	Amer. Journal of Med. Sciences, 1878, vol. lxxvi, p. 100.
Last record only few weeks after operation	Recovery(?)	Too early for definite end results	Brit. Med. Journal, 1881, vol. ii, p. 1056.
No recurrence in 1888, according to Tito Costa in Buchanan's table	Recovery(?)	Reasonably certain recovery, although may have recurred later	Melis, Extirp. della Scapola, Cagliari, 1886; Arch. di Ortop. Anno 10, No. 2, 1893. Buchanan's letter to author
Recurrence and death inside of the year	Death in less than a year	....	Personal letter to de Nancrède.
No record after report in journal	Recovery(?)	....	Austral. Med. Gaz., 1884, vol. iv, p. 39.
....	Died in 36 h. Shock	Alcoholic subject	Leçons clinique Chir., Paris, 1885, p. 235.
....	Died 1 h. from shock	....	Maryland Med. Journ., 1885–6, vol. xiv, p. 21.
Recurrences Feb. 8, 12, 26	Died in 18 m.	....	Trottmann, Ueber die Extirp. der Scapula, 1887
....	Died same day	....	Lancet, London, 1892, vol. ii, p. 471.
Sarcomatosis of lung, local recurrence	Death on 14th day	....	Arch. f. klin. Chirurg., 1889, vol. xxxviii, p. 300.
No recurrence at the end of 15 months	R(?)	Too early to determine end results	Nederl. Tydschr., v,. Geneesk, 1890, vol. xxvi, p. 521.
Last report Feb. 4, 1890	R(?)	Too early to determine end results	Le Mercredi méd., 1890, p. 51.
Lethal cause "Entero-colitis"	Died in 14 m.	Too early to determine end results	Riforma med. Napoli, May 1, 1891.
Sarcomatosis of liver, right pleura, and probably left lung	Died in 1 y.	....	Berlin. klin. Wochenschr. vol. xxxiii Nov., p. 987–8.
Recurrence 1 month, operated. Second recurrence, operation attempted, abandoned	Died in 10 w. Sepsis	Head of humerus removed because of paucity of soft part covering	Hausmann, Ueber die totale extirpat. des Schulterblattes, 1892, Erlangen.
Recurrence and removal of arm July 3, 1895(?)	R	Well February, 1900	Medical and Surgical Reporter, Phila., Sept. 9, 1893; Personal communication to Dr. Buchanan.
No further data after May, 1891	R(?)	....	Riforma med. Napoli, May 1, 1891.
Well two years later when last seen	R(?)	Too early to determine end results	The Operations of Surgery, London, 1897, p. 151; also personal letter Dec. 4, 1908.
Reported during same year	R(?)	Too early to determine end results	Bull. méd. du Nord., 1893, vol. xxxii, p. 305

TABLE I.—END RESULTS AFTER TOTAL EXCISION

No.	Operator	Date of operation	Sex Age	Condition for which operation was done	Operative results
33	J. J. Buchanan, Pittsburgh Buchanan's list, No. 56	Mar. 15, 1894	M. 34 yrs.	Sarcoma	Recovery
34	Madelung, Strasburg Buchanan's list, No. 58	Mar. 5, 1895	F. 23 yrs.	Sarcoma	Recovery
35	A. B. Johnson, New York Buchanan's list, No. 59	Oct. 9, 1895	M. 45 yrs.	Sarcoma	Recovery
36	J. C. Warren, Boston Buchanan's list. No, 60	Dec. 28, 1895	M. 14 yrs.	Sarcoma	Recovery
37	R. F. Weir, New York de Nancrède	1895	M. Adult	Sarcoma	Recovery
38	J. C. MacDonald, San Francisco. Buchanan's list, No 61	Jan. 31, 1896	F. 25 yrs.	Sarcoma	Recovery
39	T. K. Dalziel, Glasgow Buchanan's list, No. 62	Feb, 1896	M. 36 yrs.	Sarcoma	Recovery
40	J. Israel, Berlin de Nancrède	April 6, 1896	M. 36 yrs.	Myxochondrosarcoma	Recovery
41	F. J. Shepherd, Montreal de Nancrède	June 26, 1896	F. 33 yrs.	Myeloid sarcoma	Recovery
42	G. H. Eddington, Glasgow Buchanan's list, Ho. 64	Dec. 27, 1896	F. 8 yrs.	Sarcoma	Recovery
43	J. E. van Iterson, Leyden Buchanan's list, No. 65	Jan. 22, 1897	F. 30 yrs.	Sarcoma	Recovery
44	A. W. Mayo Robson, Leeds, now London Buchanan's list, No. 67	July 20, 1897	F. 20 yrs.	Sarcoma	Recovery
45	G. B. A. Moynihan, Leeds Buchanan's list, No. 68	Sept. 16, 1897	F. 23 yrs.	Sarcoma	Recovery
46	L. Piqué, Paris Buchanan's list, No. 69	Oct. 26, 1897	F. 25 yrs.	Sarcoma	Recovery
47	Wm. T. Bull de Nancrède	Nov., 1897	M. 52 yrs.	Fibrosarcoma	Death in a few hours from shock

OF THE SCAPULA FOR SARCOMA—*Continued*

Later history	End results	Remarks	Reference
A growth had been removed 4 months before scapula was excised	Died after 5 y.	Inoperable recurrence in upper jaw	Phila. Med. Journ., 1900, vol. vi, pp. 7–82.
Local recurrence Apr. 26; removed; local recurrence June 10; op. refused	Died in 5 m.	Disease in central end of humerus and outer portion of clavicle. Died Aug. 10, 1895	Deutsche Zeitschr. f. Chir. 1896, vol. xliii, p. 443.
Reported well at end of about 1897 by letter to author dated Dec. 5, 1908	R(?)	Too early to determine end results	New York Med. Journ., vol. lxiii, p. 389, also personal letter (1908) to author.
Operated twice during 1896 for recurrences	R(?)	Drowned over year after primary operation	Boston Med. and Surg. Journ., 1896, vol. cxxiv, p. 511. Personal letter to author, 1908.
Traced only about 2 months	R(?)	Too early to determine end results	Personal communication to author.
Well at last observation 5 years after operation	R	Permanent recovery probably certain	Occidental Med. Times, 1896, vol. x, p. 600. Also personal letter to author, Dec. 15, 1908
Well Feb. 1900 (4 yrs.) by personal letter to Dr. Buchanan	R	Permanent cure highest degree probable	Glasgow Med. Journ., 1897, vol. xlvii, p. 140
Resection of head of humerus had been done one year previously by Gruber of Charkow for enchondroma	R(?)	Too early to determine end results. Somewhat doubtful if this case should be included in this list	Berlin. klin. Wochenschr., vol. xxxiii, pp. 987–988.
Lung metastases recognized in October, 1898	Died July, 1899, a little over 3 y.	....	Montreal Med. Journ., vol. xxv, 1896–97; personal letter to author giving final results, Dec. 9. 1908.
....	Died in 17 m. Generalization	Generalized metastasis (see second reference)	Glasgow Med. Journ., 1897, vol. xlviii, p. 202. Brit. Med. Journ., 1901, vol. 1, pp. 954–5, April 20.
Sensory anæsthesia and deficient circulation led van Iterson to remove the arm about Jan. 29., 1897	R?	No evidence as to what end results were	Personal communication to Dr. Buchanan, who in reporting the case leads the reader to infer that there was an operative recovery.
Sarcoma of lung	Died Sept. 10, 1899, about 13 m.	....	Personal communication to Dr. Buchanan.
Rapid recurrence at operative site in 22 days, when an operation was done	Died in 37 d.	....	Brit. Med. Journal, 1898, vol. i, p. 1198.
In 1900 condition was reported as good	R(?)	External third of clavicle normal but removed to facilitate operation	Bullet. Soc. Anat. de Paris, vol. lxxii, 1897, p. 919. Piqué et Dartigues, Rev. de Chir., Paris, vol. xxi, pp. 437–488.
....	Death	....	Extract from records of New York Hospital secured by the kindness of Dr. F. W. Murray.

TABLE I.—END RESULTS AFTER TOTAL EXCISION

No.	Operator	Date of operation	Sex Age	Condition for which operation was done	Operative results
48	M. Schmidt, Cuxhaxen......... Buchanan's list, No. 70	Dec. 5, 1897	M. 57 yrs.	Sarcoma	Recovery
49	Dr. Tricomi, Rome............. de Nancrède	1899(?)	M. 47 yrs.	Myxochondrosarcoma	Recovery
50	A. Gerster, New York.......... de Nancrède	July 11, 1899	M. 8 yrs.	Sarcoma	Recovery
51	C. H. Golding-Bird, London..... Buchanan's list, No. 72	Jan. 10, 1900	F. 10 yrs.	Sarcoma	Recovery
52	E. Quenu and G. Renon........ de Nancrède	July 23, 1902	M. 16 yrs.	Sarcoma	Recovery
53	Rotter, operated by Gunkel ..... de Nancrède	1903	....	Endothelioma (Sarcoma)	Recovery
54	C. M. Stemen, Kansas City...... de Nancrède	March, 1904	M.	Sarcoma	Recovery
55	A. Nota...................... de Nancrède	Mar. 12, 1904	M. 46 yrs.	Sarcoma	Recovery
56	Chas. C. Allison, Omaha........ de Nancrède	....	....	Sarcoma	Recovery
57	G. W. Crile, Cleveland.......... de Nancrède	....	M. 12 yrs.	Sarcoma	Recovery
58	P. Bastienelli, San Giovanni Valdarno .... de Nancrède	Feb. 20, 1905	F. 9 yrs.	Sarcoma "Myelogenic osteosarcoma"	Recovery
59	F. J. Lutz, St. Louis........... de Nancrède	April, 1905	M. 31 yrs.	Sarcoma	Recovery
60	J. J. Buchanan, Pittsburg....... de Nancrède	July 1, 1905	F. 18 mos.	Sarcoma	Recovery
61	C. B. G. de Nancrède, Ann Arbor de Nancrède	Feb. 1, 1906	M. 28 yrs.	Sarcoma	Recovery
62	L. A. Dunn, London........... de Nancrède	Nov. 7, 1904	M. 35 yrs.	Sarcoma	Recovery
63	M. Lejars, Paris............... de Nancrède	July 9, 1908	F. 24 yrs.	Sarcoma	Recovery

OF THE SCAPULA FOR SARCOMA—*Continued*

Later history	End results	Remarks	Reference
Local recurrence at end of one year; a metastatic growth at exit of one sciatic nerve from pelvis	Probably (?) fatal. Last trace Jan. 13, 1899	Secondary growths in axilla were removed once	Deutsche Zeitschr. für Chir., 1898–99, vol. l, p. 394.
Traced only one month after operation	R(?)	Too early to determine end results	Extirp. completa della Scapola per sarcoma. Arch. ed atti d. Soc. Ital. di Chir. 1899, Roma, 1900, vol. xiv, pp. 263–264.
No record beyond one month	R(?)	Too early to determine end results	Festschrift, Abraham Jacobi, May 6, 1900, p. 124.
No record beyond one month	R(?)	Entirely too early for any definite end results	Personal communication to Dr. Buchanan.
Record of barely 4½ months	R(?)	Too early for any definite end results	Rev. de Chirurg., Paris, vol. xxvii, pp. 421–436.
Several weeks later head of humerus removed to facilitate healing; died of "croupous pneumonia"	Died 4 m.	Was not the "croupous pneumonia" really pulmonary sarcomatosis, producing consolidation and a simulation of genuine pneumonia?	Deutsche Wochenschr. Vereins-Beilage, vol. xxix, p. 177.
None, but information inadequate	R(?)	Alive in 1908	Personal letter to author.
Last report 6 months after operation	R(?)	Too early for end results	Gior. d. R. Acad. di Med. di Torino, 4, S. vol. x, pp. 651–657.
Visceral metastasis in two years	Died soon after secondaries appeared	....	Personal letter to author.
Early intrathoracic metastases	Died in 6 m.	....	Personal letter to author.
Well on Dec. 15, 1908, as reported by operator to author by letter	R(?)	Tip of coracoid left to facilitate operation. Enlarged axillary gland removed nearly two years later. Was well Dec. 15, 1908	Sopra un caso di extirpas totale della scapola sinistra, Polyclinico, Roma, vol. xiv, sez. prat., pp. 97–102. Personal letter Dec. 15, 1908.
....	R(?)	Reported well 32 months	Surgery, Gynecology and Obstet., Chicago, vol. iv, pp. 11–12. Personal letter Dec. 13, 1908.
Discharged within one week; later news, Jan. 22, 1909, well	R	Perfectly well Jan. 22, 1909	Personal letter to author. Jan. 15, 1909. Letter from father 1–22–1909. Kindly sent me by Dr. Buchanan.
Marked recurrence (inoperable) by Aug. 24, 1906; soon after "became numb from breast down, with secondaries probably in the dorsal vertebræ	Died of recurrence and generalization, 4 mos. 19 days	Died July 19, 1906	Hospital Record, University of Michigan.
Reported well nearly two years after operation. In 1907(?) extensive local recurrence and death	Death in about 3 y.	....	Brit. Med. Journ., March 26, 1908. Personal letter of Jan. 9, 1909 to author.
Latest report, 3 months	R(?)	Clavicle divided for convenience. Too early for determination of end results	Sarcome de l'omoplate gauche, ablation totale de l'omoplate. Bull. et Mém. Soc. de Chir. de Paris, N. S., vol. xxxii, pp. 802–4.

TABLE I.—END RESULTS AFTER TOTAL EXCISION

No.	Operator	Date of Operation	Sex Age	Condition for which operation was done	Operative results
64	S. McEwen, Orlando, Florida.... de Nancrède	Jan. 25, 1908	M. 26 yrs.	Endothelioma (Sarcoma)	Recovery
65	F. N. Pryanishnikov........... de Nancrède	1908	M. 7 yrs.	Sarcoma	Recovery

TABLE II.—CASES WHERE MORE THAN THE SCAPULA WAS INVOLVED
BEING REMOVED AT ONE SITTING WITH PRESERVATION

No.	Operator	Date of Operation	Sex Age	Condition for which operation was done	Operative recovery
1	Von Langenbeck, Berlin........ Buchanan's list, Case 1	May 22, 1855	M. 12 yrs.	"Malignant growth" (Sarcoma?)	Recovery
2	M. Michel, Strasburg........... Buchanan's list, Case 12	Sept. 20, 1868	M. 50 yrs.	Cyst of bone, almost certainly benign	Recovery
3	J. Spence, Edinburgh........... de Nancrède	Dec. 25, 1871	M. 68 yrs.	Tumor	None
4	G. Poinsot, Bordeaux.......... Buchanan's list, No. 31	Sept. 6, 1884	M. 52 yrs.	Sarcoma	Death
5	A. MacCormac, Sidney.......... Buchanan's list, No. 38	April, 1887	M. 56 yrs.	Sarcoma, primary in muscle	Recovery
6	C. H. Golding-Bird, London..... Buchanan's list, No. 52	Mar. 28, 1893	F. 14 yrs.	Sarcoma	....
7	P. Berger, Paris................ Buchanan's list, No. 66	June 2, 1897	F. 21 yrs.	Sarcoma	Recovery
8	C. M. Stemen, Kansas City...... de Nancrède	Nov. 14, 1899	M. 51 yrs.	Sarcoma	Recovery
9	M. Poisson.................... de Nancrède	1905	M. 30 yrs.	Sarcoma	Recovery

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* I desire to express my indebtedness to Dr. C. A. Pfender, of Washington, D. C., and to Dr. M Kollig, of Ann Arbor, Mich.

OF THE SCAPULA FOR SARCOMA—*Continued*

Later history	End results	Remarks	Reference
Last accessible report less than seven months after operation	R(?)	Too early to determine end results	Journal of the Amer. Med. Association, vol. li, Aug. 29, p. 757.
Inoperable metastases in less than 2 months on head	Died. Exact time not given	Resection of the head of the humerus and portion of the clavicle "for the purpose of securing a better joint," but they were apparently uninvolved by the neoplasm	Khirurgia, Mosk., vol. xxiii, pp. 141–148.

IN THE NEOPLASM, ALL OF THE SUPPOSEDLY DISEASED TISSUES OF THE REMAINDER OF THE UPPER EXTREMITY.

Later history	End results	Remarks	Reference
Recurrence in 109 days	Died in 3½ m.	Three inches of clavicle removed because imbedded and involved in the growth	Fock, Deutsche Klinic, 1855, No. 38, p. 422.
No recurrence	Recovery lasting over 5 y.	Microscopic description indicates probably a relatively benign myeloid growth	Levrey, Resection complète du Scapulum, 1869; also Case 3 of Heldrich, Totale Resectionen der Scapula, Diss. 52 p., Muenchen; Also Gaz. Hebdom. de méd., Paris, vol. ii, pp. 432–435.
Rec.?	....	Clavicle divided for convenience. Clinical diagnosis; malignant. Course pursued and microscopic appearances left Mr. Spence in doubt.	Lect. on Surg., 3d ed., vol. i, p. 963 et seq.
No time for recurrence	Died in 2 d.	Outer portion of clavicle involved and removed; head of humerus excised for better shaped shoulder. "Gangrene gazeuse"	Rev. de Chir., Paris, 1885, vol. v., p. 201.
Operation for recidives June and December 1889; patient well 1898	R	Acromium sawn across at base and left. Growth primary in serratus magnus muscle, later involving scapula, the recidives, required removal of portions of the external intercostals; cautery freely employed	Australasian Med. Gaz., 1898, vol. xvii, p. 295.
Recurrence in wound and axilla	Died in 1 y. 5 d.	A part of the clavicle was involved in the disease and removed	Lancet, London, 1893, vol. i, p. 1066; also personal communication to Dr. Buchanan.
Recurrence of growth excised early in 1899	R(?)	Latest report March 1900; too early for definite end results. Primary growth was in the trapezius, secondary in the scapula and clavicle, a portion of the latter being removed	Bull. et Mém. Soc. Chir. de Paris, 1897, vol. xxiii, p. 571. Later personal letter to Buchanan.
Removal of one half of clavicle because involved by the neoplasm	Died 19 hours after operation	....	Personal letter to author.
No definite after history	R(?)	Curettage of a neoplastic area in the head of the humerus	Ablation totale d'omoplate. Gaz. Méd. de Nantes, 2. S. vol. xxiii, pp. 114–115.

successes (?) the cases of the following patients whose records are complete, who died from the operation or its results, or from either recidives or metastases, or where the data were too incomplete to determine the "end results."

Case number.	Results.
1.	Died in two months.
2.	Died in six months.
3.	Died in ten months.
4.	Apparent recovery, already referred to.
5.	Died in ten months.
6.	Died in six months.
7.	Died on fifth day.
8.	Died in five months.
9.	No data after two years.
10.	Died in six months.
11.	Died in four and one-half months.
12.	Died in six months.
13.	Died, no date.
14.	Observed three months.
15.	Observed few weeks.
16.	Probable cure.
17.	Died under one year.
18.	Died in a few months.
19.	Died in thirty-six hours.
20.	Died in one hour.
21.	Died in eighteen months.
22.	Died on same day.
23.	Died on fourteenth day.
24.	Died in fifteen months.
25.	Died in three and one-half months.
26.	Died in fourteen months.
27.	Died in one year.
28.	Died in ten weeks.
29.	(Phelps) probably cured.
30.	Observed only a few months.
31.	Observed only two years.
32.	Died under one year.
33.	Died in over five years.
34.	Died in five months.
35.	Observed only about two years.
36.	Drowned about four years after last operation.
37.	Traced only about two months.
38.	Died from recurrence after sixth year.
39.	Probable cure.
40.	Only a few months.
41.	Died in three years.
42.	Died in seventeen months.

Case number.	Results.
43.	No later history.
44.	Died in thirteen months.
45.	Died in thirty-seven days.
46.	Probable cure but too early for reliable results.
47.	Died in probably two years.
48.	Only traced one month.
49.	Only traced one month.
50.	No record beyond one month.
51.	Record only four and one-half months.
52.	Died in about four months.
53.	Possible cure.
54.	Record only six months.
55.	Died in over two years.
56.	Died in six months.
57.	Nearly three years, possible cure.
58.	Observed thirty-two months.
59.	Observed over three and one-half years.
60.	Observed three years and seven months, then well.
61.	Died in five months.
62.	Died in three years.
63.	Observed only three months.
64.	Observed less than seven months.
65.	Died from early inoperable cranial growths within less than two months.

Cases 48, 49, 50, 51, 53, 57, 58, 63, 18 and 63 have no reliable record as to " end results," having data lasting perhaps only one week, one month, four and a half, six months, up to and at most thirty-two months in one case. In the light of the evidence of recurrence, as shown by the records of other cases already quoted, who can doubt that the " end results " if known, would be as bad as those already finally determined, *i.e.,* usually death, possibly one or two recoveries.

Putting the facts in another way, out of 65 cases, 26 were dead in less than one year, 3 were dead inside of eighteen months, 2 survived two years, 2 lived for three years and 1 for five years before succumbing. Thirty-five then died inside of two years—over one-half.

Of the 9 cases included in my second table where disease had invaded the surrounding tissues requiring their removal, and including two cases where the diagnosis was doubtful, the showing is not materially better.

Case No. 1 died in three and one-half months; Case No. 2 was well over five years but the malignancy of the growth is much in doubt; No. 4 died in two days from wound infection; No. 5 where the growth was secondary in the scapula was well nine years later after repeated operations; No. 6 died in one year and five days; No. 7 was only observed about one year; No. 8 died in nineteen hours; while concerning Nos. 3 and 9 there is no definite history.

To what conclusions does this sorry showing drive us? That except under peculiarly advantageous conditions, we cannot hope for much prolongation of life, and still more rarely for a permanent cure. This latter can only be secured by a very early operation—almost as soon as the growth is diagnosed. Unfortunately, in certain instances, even the earliest possible intervention will prove unavailing, probably owing to the unusually favorable relations of the minute blood-vessels of the growth to the neoplastic cells, presenting facilities for their embolic dissemination.

The probabilities as to operative death; whether recoveries are more common than in the past; the probabilities of local or general recurrence; whether these are early or late; to what late death is due when operative recovery occurs; and can excision of the scapula be considered a curative operation, are best and most fully answered by a study of my tables,—nevertheless, I shall dwell chiefly upon some of these points. One question as to whether life is prolonged when death results from recidives or generalization cannot be answered, as there are no data securable as to the natural history of unoperated sarcomata of the scapula.

Study of the literature reveals other data than those which I can now give, showing how commonly recurrence in loco takes place, and how probable it is that the recidives provide the foci whence generalization occurs, the primary growth having been removed before metastases had taken place; hence, if local recurrence is preventable by earlier operation, a certain number of fatal cases of visceral involvement might be avoided. At once the question suggests itself, might not an interscapulo-thoracic amputation instead of an excision of the scapula render possible a much wider extirpation of the tissues in which recidives occur, and thus lead to a greater number of permanent recoveries? The evidence on this point I have not attempted to secure but would urge that this investigation be made in the near future by some one of the Fellows.

The commonly accepted reasons for the early metastases by the vascular system are too well known to need mention, but I believe clinically, too much stress is unwittingly placed upon one fact and too little upon another, unconsciously creating a tendency to fall into a most serious error. Because lymph-node infection is a not uncommon possibility in sarcoma of bone, in the absence of any such complication, when no obvious visceral metastases are detectable, we too often ignore the probability of the presence of innumerable minute metastatic deposits in the lungs and other organs, which from their small size, their number and uniform dispersion throughout the viscera, defy detection by the most expert diagnostician *at the time of operation,* too often to demonstrate their fatal presence after all the primary focus has been thoroughly removed, and where no recidives appear in situ, whence the generalization could have occurred.

While my tables cannot be made to show in a definite way the propriety of these statements, the extended histories of many of these cases fully warrant my assertions.

Although these cases do not appear to bear upon the question of the lessened operative mortality of excision of the scapula, operative removal of the scapula for other conditions as well as the more recent cases included in my tables, show that total excision of the scapula is somewhat less dangerous than formerly. Possibly some patients who died in the past of shock and hemorrhage, had they survived would have shown additional cures, so that the probabilities of slightly improved "end results" may be anticipated. If this operation is performed for unquestionably benign growths, it is entirely proper and should prove increasingly successful. Percentages, as before stated, are misleading rather than informing, hence none such will be given.

Certainly metastases and recidives are common, if indeed metastases have not already occurred before operation, but have been overlooked.

With very few exceptions, all complete histories sooner or later show that death resulted from local recurrences or generalization throughout the economy.

Although I am unwilling to take an extreme position, if the positive diagnosis of malignant disease can be made, I shall, I think in the future, recommend early intercostohumeral amputation, until this procedure is also proved to be inferior, or no better, in the "end results" than complete excision of the scapula alone, and I shall set my face absolutely against any partial resections of the shoulder-blade for malignant disease.

No one can deny that retention of the remainder of the upper extremity is desirable, and that it is always of some utility, while in many the ability to use the arm is surprisingly good. Nevertheless, life should be considered first, utility last.

None would be more pleased than I to have my gloomy forecasts disproved, but I cannot shut my eyes to what I have learned from a study of the literature of the subject. The outcome of my investigations was a complete surprise to me, as I anticipated a far different result.

In conclusion, permit me to ask a careful consideration of my tables, prepared only after the consumption of a vast amount of time and study and which have led to such unforeseen conclusions. I would also insist upon the propriety of the application of similar methods to the study of some of our accepted plans of treating other diseases. This is not my first experience of the disillusionizing effects of a study of "end results." A number of years ago I read a paper in Chicago, where my own experience and that of others to which I had access, demonstrated *by the end results,* the almost certainty of ultimate failure to cure focal and Jacksonian epilepsies by the excision of the discharging cerebral lesions.

THE OLD, AND THE BEGINNING OF THE NEW, IN SURGERY.*

BY J. EWING MEARS, M.D.,

OF PHILADELPHIA.

It has happened to the writer to have lived in one of the World's periods of greatest activity and progress. It may be questioned whether the last half of the Nineteenth Century cannot claim the maximum of development in those conditions which have contributed to the improvement of man's stay on earth. In considering these conditions, and the influence exerted by them, it must not be forgotten that the foundation upon which they are builded and upon which they rest, took origin at the very beginning of man's existence—at the dawn of creation,—and the structure of knowledge has grown progressively through the contributions which have been made in successive periods of time, influenced by the conditions of life which have constituted their environment. This, it may be said, has been eminently true in the development and growth of surgery—at one time the legitimate part of the barber's art, and emancipated only from this ignoble association when the genius of those who were its disciples gave to it its proper place as a part of the science of medicine, through the ingrafting of the principles of that science which were essential to its development and growth. In the successive ages of the World's history the value of life has been measured by the increase in knowledge of the means of its preservation, and all efforts have been directed to those ends, until in this day the prevention of disease, through the prevention of the causes which produce it, has become the ideal object of the labors of the disciples of the art of healing.

In view of the limit the writer has fixed for the discussion of the subject expressed in the rather comprehensive title of his paper, he is moved to state that it will concern chiefly his own experience, which covers nearly the last half of the last century. In that period of time two of the most important and controlling contributions to surgery have been made—the general introduction of the use of ether as a anæsthetic agent in major surgical operations and the method of antisepsis in the treatment of wounds.

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* Read by title before the American Surgical Association, June 4, 1909.

With regard to the first, it has occurred to him to witness operations upon patients who had been placed in a state of insensibility, more or less complete, by large draughts of alcoholic stimulants or by the administration of opiates in unusual quantities. Firmly bound to the table the patient has been unable to offer successful resistance and the operative procedure was conducted to the end, despite the agonizing cries of pain and suffering. These conditions of necessity limited surgical interference to cases of absolute emergency and those which involved the extremities, as a rule, and which were the result of accidental injuries. Great as was this boon, general anæsthesia, to suffering humanity, the agent employed possessed certain objections, the chief one being that of the nausea following its use, in many cases, and the effort has been continuous to obtain a substitute freed from this condition. Up to this time many agents have been added to the list of anæsthetics, local and general; but attached to each there has been found to exist some element, either of danger or unsatisfactory efficiency, and the search, through observation, practical experience, and laboratory experimentation continues in order to find the ideal substance—one capable of producing complete insensibility to pain without the loss of consciousness. The nearest approach to the accomplishment of this desirable condition would seem to have been found in the use of stovine by lumbar puncture; but this method is not free from elements of danger, which, in reported cases, have led to fatal results.

Taking a fundamental part in the development and growth of surgery in the time set apart, were the methods of instruction in vogue in the beginning. The sessions of the medical colleges were short, at most, not more than three and a half to four months in each year, and the student, while he was expected to enter at the beginning of the course, was permitted to begin his collegiate studies after a large part of the session had passed. A requirement for entrance and for the privilege of appearing for the examination for the degree of Doctor in Medicine at the termination of the two years' course of instruction, was a presumed year's study and apprenticeship in the office of a practitioner, whose qualifications as an instructor were quite an unknown quantity. No conditions were imposed as to preliminary education. Graduation from a school of high grade was rare, and still rarer was the possession of the degree of Bachelor of Arts by the candidate for admission. The methods of instruction were didactic, and the student sitting on the benches for two courses in succession heard the lectures of the first course repeated, without, in most instances, addition or emendation. When the learned professor read his lecture from manuscript pages, it has happened, to the knowledge of the writer, that the paper was yellow with age and the text was as ancient as the paper. The dissecting room was the only laboratory, and the work done therein was largely of a perfunctory and defective character, concluded without any test by examination in the presence of the dissected specimens, of the knowledge gained by the student. The fee for instruction paid by the student was outside of the college ticket and was the emolument of the demonstrator, and did not reduce the sometimes large receipts of the professors, who received all of the income of the college, paid the expenses of maintenance and divided the remaining balance, sometimes giving to each from five to eight thousand dollars in the year.

The large sum obtained by the professors each year was increased by the sale of the text-books, written by them, copies of which each student was expected to buy—if his financial resources permitted such expenditure. As the lectures of the professors were embodied in these books it was to the advantage of the student to possess them, and the study of them assisted in the work of preparation for the final examination. In a way it may be said that the text-books on different medical subjects written by the professors who taught the branches, were more useful to the student than those written to-day by a number of authors and edited by one or two. As a student, in the text-book of the teacher he receives instruction which is individual, and not the opinions of many who may treat the subjects in very different ways. As a graduate and a practitioner the text-book of many authors may possess for him positive advantages and assist him in his work.

Anatomical material was expensive, and, in the absence of legal provisions by the State, sometimes difficult to obtain by methods short of " Burking," with the suspicion even that this method was resorted to. The surgical laboratory did not exist, and the student, as a rule, received his degree, which declared him qualified to practice surgery without having received any practical instruction in the application of surgical dressings or in the performance of surgical operations of either minor or major character upon the cadaver. The student who felt the necessity of possessing practical knowledge on this subject was compelled to obtain a cadaver at his own expense and pay a private instructor for the instruction given.

In the days spoken of, at a later period, the eminent teacher of surgery in Jefferson Medical College, Professor Samuel D. Gross, organized, as a part of the instruction of his chair, a surgical laboratory, and the writer was appointed to take charge of the department of surgical dressings, sharing the duties with a colleague who gave instruction in operative surgery. Later, the entire instruction in the laboratory came under the writer's care and the student received instruction in the laboratory, which was made compulsory, without extra fee. This condition the writer earnestly advocated, feeling that every student receiving the collegiate degree should be required to receive instruction of this character, and without extra cost. It is believed that the surgical laboratory, thus organized by Professor Gross, was the first established in the medical colleges of this country. The branches of medicine which were included in the curriculum were the traditional seven, Anatomy, Physiology, Materia Medica and Chemistry, Principles and Practice of Medicine, Principles and Practice of Surgery, and Obstetrics. With the exception of anatomy the fundamental branches were taught only by lecture and laboratories, for experimental and practical work in these branches were absent. Students who were ambitious to gain practical knowledge in materia medica, had the opportunity in certain apothecary shops, where they were instructed in the art of making pills, powders and certain simple mixtures. In medicine, clinical instruction was given by the professors in turn, those occupying the chairs of anatomy and surgery giving clinical instruction in surgery in the divided halves of the term. Clinical material in medicine in the college clinics was limited entirely to walking cases illustrating chronic affections, as a rule of the stomach, not extending in nomenclature beyond dyspepsia or what was vaguely designated as chronic gastritis. The diagnosis, in each case, was most frequently, if not always, made without physical examination and based upon the very vague and non-intelligent information given by the patient. The treatment was eminently empirical: a condition of inflammation being assumed as the diagnosis, counter-irritation to the extent of blistering was advised, and enforced over the epigastric region, or, as more intelligently conveyed to the patient, over the pit of the stomach. When torpor of the liver was the suspected diagnosis, remedies which would administer a fillip to the lining membrane of the intestine were regarded as indicated in order to invite and stimulate hepatic activity. There were no obstetrical clinics as such. Gynæcology was taught by lectures, the use of the speculum was demonstrated upon models or the cadaver; physical examinations were not permitted to be made before the class by the teacher, and the members of the class were not permitted to make, even under the guidance of the instructor, in the clinical room, such examinations. The solid stick of silver nitrate, more commonly designated lunar caustic, was the agent universally applied for morbid affections of the cervix uteri, and displacements were most frequently unsuccessfully relieved by the use of very varied and uncomfortable mechanical appliances. Believing that students in medicine should have practical instruction in the methods of making digital examinations, the writer at one time conducting the gynæcological clinic, arranged to give instruction in this branch in the retiring room of the clinic to the class, in sections. The instruction was prohibited by the controlling powers of the institution as not conforming to the rules, which protected the female non-paying patient from usage not agreeable to her sense of modesty. Instruction in practical obstetrics was obtained by students who felt its necessity, on the payment of a fee, in lying-in-homes. When sufficiently instructed in the institution they were permitted under the guidance of a practicing physician to take charge of cases in the homes of non-paying patients. At an earlier date somewhat, than that of which we write, the writer has been told that, in the then frontier West, the act of parturition was accomplished while the wife was held on the lap of the husband, a limb each confided to the care of sympathizing women neighbors, whilst the physician sat on a stool between the two. It can be readily understood that this position was not one of comfort to any who were required to take part in the procedure which, in the case of primiparæ was likely to be of a prolonged character.

Clinical surgery was taught in the college amphitheatre, and, as well as clinical medicine, in certain hospitals which had lecture rooms in the buildings. In the college amphitheatre the instruction was given by the professor of surgery, or, if a practicing surgeon, by the professor of anatomy. In some instances, one or two rooms in the college building not very remote from the odors and pathologic conditions of the dissecting room were assigned for the reception of patients who had been submitted to major operations in the clinic. Blood-letting for inflammatory affections was practiced and the writer, while on duty in the surgical clinic was directed by the professor on one occasion to bleed a patient suffering from acute iritis. Inquiring as to the number of ounces which should be let, the answer was as follows: "Ounces! Bleed him, young man, until he falls over," and the orders were strictly obeyed, with the happy result of prompt relief of the phlogistic conditions. In the hospitals the students were not permitted to "walk the wards,"—the closest contact they had with the patients was from the benches of the amphitheatre, large enough, in some cases, to seat six hundred students.

Associated with the subject of the conduct of medical colleges, in the day of which we write, it is interesting to consider their method of organization. In some States the Legislatures granted charters to medical colleges which were parts of a sweeping franchise to construct a railroad and, possibly, one or two other enterprises of commercial character. These charters came into the possession usually of members of the medical profession with political proclivities, who sold them to other members of the profession ambitious to acquire the title of professors. Some of these colleges, thus organized, were undeniably fraudulent in character and conduct,—endowed, under the charter with colossal powers and privileges they conferred degrees of all kinds from A.B. and M.D. to LL.D. and D.C.L., in the majority of cases "in absentia," and for sums of money varying in amount according to the financial ability of the intending purchaser. The conferring of these degrees was not limited to this country, but extended quite over the World. In Great Britain and the continent of Europe the business became a subject of international interference, and happily, for the good repute of the medical profession of this country, it was stopped. In marked contrast the medical colleges of to-day, with possibly a few exceptions, can claim a greatly improved condition of excellence in the requirement for entrance, one, the Harvard Medical School, exacting the degree of Bachelor of Arts,—in the extension of the sessions,—expansion of the courses of instruction—organization and conduct of the laboratory systems, and all methods which contribute to the complete education of candidates seeking admission into the medical profession.

General hospitals, even in the larger cities of the country were few in number, limited to one or two at most. Among those most closely associated with clinical teaching and venerable in years of existence were the Massachusetts General Hospital in the city of Boston and the Pennsylvania Hospital in the city of Philadelphia, founded by William Penn. The clinical amphitheatre in this hospital was unique in character, having been constructed in what may be called the cupola of the main building, in a space so restricted that the students sat on benches almost overhanging in position, and looked quite directly down upon the teacher and patient.

In the days of which we write the operations performed in the clinics were usually in the form of amputations and the removal of external growths. Operations upon the cavities of the body were limited to the cranial, and did not pass beyond the use of the trephine in cases of depressed fracture. Paracentesis of the chest and abdominal cavities was performed for dropsical effusions. Thoracentesis, with rib resection, was not practiced, and although McDowell had opened the gateway into the abdominal cavity through his operation for the removal of ovarian tumors, this operation was rarely performed, and then not in the public clinics. The writer recalls an interesting experience which came to him on the occasion of a visit to one of the hospitals connected with the teaching in the University of Edinburgh, when a distinguished ovariotomist was required by the authorities of the University to perform the operation of ovariotomy in the public clinic. He protested that the conditions surrounding operations in a public clinic were hostile to any operation which involved the opening of the abdominal cavity. Yielding, however, to the official mandate, he did the operation, which fortunately happened to be of a very simple character, and when it was completed, remarked to the class of students: "Well, you didn't see anything, did you?" Cæsarean section had been performed in a few instances, and Dr. John S. Bobbs, of Indianapolis, Indiana, had performed the first operation of cholecystotomy.

In private practice surgical operations were performed in the homes of the patients, in bed rooms and in living rooms, without any special preparations as to cleanliness. On one occasion, when the writer assisted in an operation of abdominal section—ovariotomy—the operating room was in the top story of a tenement house, under the roof, in a narrow alley-way. During the operative procedure a sudden and heavy thunderstorm occurred with a deluge of rain, and the water poured through openings in the ancient and perforated roof, one stream being so directed that, before the assistants could interfere, it entered the abdominal cavity through the large incision which had been made to effect removal of the adherent tumor. Efforts were made quickly to place the operating table, the usual kitchen table, in a place better protected from such irrigation methods. It was felt, however, by those present that the storm water was as clean, if not cleaner than that which was used from the somewhat battered and discolored tin hand-basin. The operating table in the homes was usually the kitchen or double-leafed dinner table, which were firmer than the bedstead or lounge which were sometimes brought into service. In one case, the writer excised the greater part of the upper jaw in a patient, who being addicted to the excessive use of alcoholic stimulants, became frenzied during the ether administration, and, flinging aside the assistants, men and women of the household, threw himself upon the floor. Extra help was summoned, which sitting upon the patient in his prostrate position, controlled him while the operation was completed—patient, surgeon, and assistants being well bespattered with blood. In another case in which the writer was called in consultation, the patient, a burly chief of police of the town and an alcoholic subject, during the process of ether inhalation sprang from the lounge in the stage of stimulation, went to a closet, and seizing a loaded revolver stalked about the room in a very menacing manner. The family physician, a brave and resourceful man, taking advantage of a convenient opportunity, leapt upon his back, pinioned his arms, and in this position directed his movements skillfully to the open door, the frightened assistants meanwhile emerging from safe places of refuge which had been sought at the time of the impending danger. In this case, the operation was completed without the further administration of the anæsthetic agent.

Associated with these conditions of improvised operating arenas was the indifference manifested by the surgeon and his assistants with regard to the state of cleanliness of the operating instruments, of the sponges and other materials used in the wound-cleansing during the operation, and in the subsequent dressings which were applied. The instruments were not many in number, made with bone handles, white or black in color, often with dull cutting edge and kept either in an operating case or placed loosely in a bag of convenient size. The sponges, which were universally employed in the wound cleansing, were those gathered from the sea and found in the apothecary shops. Those known as surgical sponges were usually of finer texture than the ordinary bathing sponges. Frequently they were charged with calcareous particles and prickles that were almost microscopic which proved to be irritating to the wound surfaces as well as to the fingers of the assistants using them. The sponges, if of good quality, were very enduring and did duty for a long period of time. One distinguished ovariotomist was accustomed to replenish his stock of *three* sponges at the beginning of each year. He never used more than that number, and they were always accounted for after an abdominal section, in order to prevent the untoward accident of permitting one to remain enclosed in the cavity when the operation had been completed, an accident which has happened in several recorded and some unrecorded cases. It is known to the writer that after operations the sponges have been used to remove blood from the table and even from the carpet or floor. They were cleansed after operations either in the basins which had been used to contain the hot and cold water, which alone was applied to the wounded surfaces, or under the hydrant in the back yard, if the patient lived in the home of the poorer class. They were placed uncovered in the bag containing the instruments in which was also frequently concealed the morbid specimen which had been removed by operation. The basins containing the water used during the operation came either from the kitchen or bed-room, and the dressings and bandages were often obtained by tearing them from unlaundered sheets or muslin or linen underwear.

The garb of the surgeon was sometimes a rubber apron of large dimensions or a coat known as a generally used linen duster, on the sleeve or body of which the blood-clotted knife was frequently wiped. The assistants performed the duties assigned to them in their shirt sleeves divested of coat and vest. In the absence of proper conveniences the hands were not washed. In cases of malignant character or those accompanied by foul discharges they were anointed with olive oil or lard. The effort was constantly made to protect the surgeon and his assistants from dangers coming from the patient, not the patient from dangers coming from those taking part in the operation.

The writer has been told of an instance in which a very prominent ovariotomist of the middle West, who suffered from vesical calculus, accompanied by a severe cystitis, stopped twice during the performance of an operation, took the soft catheter from the place beneath the sweat-band of his hat, lubricated it with spittle, evacuated his bladder and continued the operation without washing his hands. Of another surgeon who, during an operation for amputation of the thigh, overheard the casual remark of one who was present that the patient looked as if he had "phthisis." He had made the anterior flap, but put the amputating knife upon the table and proceeded to make a physical examination of the patient's chest, one of his assistants holding his thumbs over the femoral artery with some anxiety during a somewhat prolonged procedure of auscultation and percussion.

The after care of patients in the hospitals was a duty undertaken, as a rule, by convalescent patients, or in some cases, by men and women who served as nurses for a slight compensation. As can be conceived, by these methods, patients suffered from ignorant and at times cruel treatment. The writer recalls an instance which happened during his term of service as interne in the hospital of a large eleemosynary institution, in which the nurses were taken from among the number of pauper inmates, some of whom belonged to the criminal class. On one occasion when a wound was being dressed, the nurse placed his foot, encased in a dirty boot, upon the bed, and spat tobacco juice from his foul mouth directly into the water contained in the dirty basin which was used in the effort at the supposed cleansing of the wound. This act was regarded as the limit of endurance, even in those nonaseptic days, and the offender was promptly relieved of his duties as nurse and sent to the kennels of the out-ward department. In the homes the care of patients after operation was assigned to the female members of the family or friends who volunteered their services. Under these conditions the patients received kind treatment and good care, sometimes endangered by the emotions which sprung from the warm heart of the attendant, whose conception of sick-room discipline was thereby influenced.

In no way was the absence of regard for cleanliness more forcibly illustrated than in the use of the catheter in hospital and in private practice. In the former the unwashed instrument was frequently used after lubrication with olive oil or simple ointment contained in vessels which had been in use for long periods of time, affording in this way easy access into the bladder of septic germs. In private practice the metal instrument carried in the pocket case, and lubricated in the home with lard or butter, was used. When the soft or rubber instrument was introduced the walking patient was instructed how to use it, and carried it conveniently coiled up beneath the sweat-band of his high hat, and when used in inconvenient places, lubricated it with spittle.

Of the dressings most frequently used after operations to combat inflammatory conditions the emollient poultice was most popular. It was made of stale bread crumbs with water or milk, but most generally of flax-seed meal. The directions given by the learned professor with regard to the preparation of this last poultice were very specific in character, and unless these were strictly followed failure was predicted. The test given of the proper consistency was to be found in the adhesion of the mass to the side wall or ceiling of the room when projected against these parts of the room structure. At the final examination of the candidate for the degree given by the college, his ability to practice surgery was determined, to a certain extent, by his knowledge, in minute detail, of the poultice preparation. In the lectures and text-books poultices were classified according to the effect to be accomplished: as emollient, astringent, stimulating, fermenting, rubefacient, narcotic, etc. Suppuration in the wound followed the use of the emollient poultice and the discharge of pus was, as a rule, very copious. The wound condition was determined by the character of the pus,—if laudable, favorable; if sanguinolent or ichorous, unfavorable. Among other forms of dressings the writer recalls a case of amputation at the hip joint in which the stump was kept bathed with laudanum (tinctura opii) and without any manifestation of the toxic effect of the agent used.

During the Civil War the discipline which was enforced in the camp and on the march was carried, in some measure, into the management of the General Hospitals of the Service, with favorable results as to conditions of cleanliness in operation and in wound treatment. In this respect, however, the results were influenced to a large extent by the qualifications of the surgeon in charge, or of the inspector who made his tours of inspection. Notwithstanding the precautions taken and those which were born of the knowledge of the time, the mortality was very great. Gangrene, designated hospital gangrene, was of a most virulent type and resisted all known methods of prevention or treatment. The ignorance with regard to the influence of germ infection led to the tolerance of conditions most productive of disease dissemination, and thousands of lives paid the penalty for what was then regarded as a state of inevitable ignorance. The lessons, however, were not lost, and the faithful, earnest surgeons of the day, groping their way through the darkness sought the light which was to be reached in not many years to come. The General Hospitals were located in cities and, where possible, in the suburban parts, in the search for better air and surroundings. In some instances these were large wooden structures constructed upon the pavilion system, which gave both light and air. They contained usually a large number of both medical and surgical cases, and the physicians and surgeons in attendance were largely chosen from those practicing in the cities, with some officers of the regular service. In the emergency, large buildings in the cities, which had been constructed for factory or mill purposes, were taken and converted to hospital use. That these should fail to give the best results, by reason of former use and character of construction, was to be expected, but the needs of the Service demanded such provision for the sick and wounded, who in the large variety of diseases and wounds from which they suffered furnished a great school of instruction to the intelligent and observant physician. Chloroform, unmixed with other agents, was the anæsthetic largely, if not altogether, used in operation, and many lives, it was reported, were sacrificed through its careless administration. The need of medical men in large numbers to supply the demands of the Service led to the appointment of many not fully qualified, but as a rule the surgeon, especially in the emergency of Service in the field hospital following great general engagements, was found to be equal to the duty imposed. The writer recalls two instances in which wounded soldiers were brought to a military hospital in which he was the temporary acting executive officer, with extremities suffering from compound fractures, the result of shell wounds; in one the limbs were encased in an excellent supporting dressing made from the bark of a tree, and in the other, rails, taken from the ordinary rail fence of the country did good service in affording support and permitting comfortable transportation.

The large number of pathologic specimens obtained and preserved, with full histories of each, laid the foundation for the valuable collection in the Army Medical Museum, the development of which, with the Surgeon-General's Library, was so successfully promoted through the work of our distinguished Honorary Fellow, John S. Billings, at one time the efficient surgeon in charge. In the ending days of the War the writer met in London, Sir James Ferguson, the celebrated English surgeon and teacher who remarked, in commenting upon the work done by the medical profession of our country in that heroic struggle, that the members had done splendid work and deserved great credit for what they had accomplished. No war, certainly none of modern times has offered such opportunities for the study of diseases and surgical conditions incidental to the life of the soldier in field and camp and in the deadly conflict of arms. The arm of precision today projects a missile the purpose of which is to disable, to put the soldier out of service—in the time of which we write its duty was to destroy life, discharging, as it did, the large death-dealing minie ball. Following the experience gained in the Civil War, surgical endeavor was greatly stimulated and methods were improved. In this period also, and later, there appeared operations which may be designated, as in a way, fashionable. The organs of generation in the female and near-by parts presented a large field for exploitation, and operations were performed for the relief of supposed functional disturbances, correlated with supposed grave constitutional conditions. Freed from the difficulties and dangers of organic changes the hand of the tyro and empiric found free play. Condemned by professional opinion and judgment these operations have been stricken from the list of those necessary to be performed, or justifiable in purpose. Unfortunately for the good repute of surgical science, this glamour of professional notoriety, promoted by the eager desire of commercial success, has been in a measure transmitted, even to this day, and confiding patients have been, shall we say, the victims of the untoward results of surgical procedure not necessary for the relief of supposed morbid conditions. But this is passing,—the stern verdict which true science renders when sitting in judgment on the work of those who assume to be its disciples, consigns to merited punishment those who violate its principles and degrade the standard of its code of ethics.

The operations, claiming in these days to be the most important, and involving as well danger by reason of their character and magnitude, were amputations at the hip joint, ligature of large arterial trunks, and the removal of ovarian tumors by abdominal section. In the former operation the percentages of success were fairly good. The text-books of the day gave prominent position to a surgeon of local repute who had three successful cases—in succession. A mortality not exceeding 32 per cent. was regarded as most favorable in operations of ovariotomy,—and this percentage prevailed when the cases were those of non-adherent monocysts. In multi-locular cysts with parietal and visceral adhesions, the percentage of mortality was greatly increased, exceeding often 50 per cent. The writer, as the assistant of the distinguished ovariotomist, Dr. Washington L. Atlee, contributed a chapter on the "Pathology of Ovarian Tumors" to his book, and in this he announced what he regarded as a discovery of some interest, to the effect that the pathological conditions which followed operative interference had an important relation to the length of the incision made in the linea alba in the abdominal section. The small incision was only possible in simple monocysts in which, when the fluid contents were being drawn off, the flexible walls of the cyst could be drawn into the opening, and effectually sealed the abdominal cavity, thus preventing the ingress of the air, and with it the then unknown and unrecognized myriads of organisms with which it was charged. The knowledge of the day did not permit of an understanding of the relation of cause and effect involved in these conditions. Experience had demonstrated that the air in coming in contact with the surfaces of a wound or the lining membrane of a closed or serous cavity, was harmful, but in what manner it acted was not known. It remained for Lord Lister to solve the problem and to devise a system through which these organisms were destroyed and the process of putrefaction in wounds prevented.

In the decade included between the years 1865–1875, the dawn of a new era appeared in surgery: the beginning of the new—the new built upon the work of the old, surcharged as it was, of very necessity, with ignorance born of the absence of knowledge beyond the discern of man. The wound conditions with which the observant surgeon had to deal led in time to the recognition of the fact that they were not normal, that there were no conditions in the tissues themselves which should generate them, and that their causes must be sought for outside. The experimental researches of Pasteur determined the causes of putrefaction, and it remained for the reflective mind of Lister to associate these causes with the abnormal conditions observed in wounds. The result of his painstaking and laborious effort was the creation of a system which prevented the introduction of putrefactive influences into wounds, the destruction of the organisms of putrefaction, everywhere existent, before or after their admittance into a wound cavity. This was the beginning of antiseptic surgery, a monumental contribution to the science of which Lister was an illustrious disciple and one which has influenced its development as no other which has ever been made. In the gradual process of refinement from the crude but efficient antagonistic measures and combative dressings to the perfected system of to-day, antiseptic surgery has been deposed, and aseptic surgery rules in its stead. The foul kitchen basin has given place to the porcelain lined tray,—the sea-born sponge, with its myriad cells charged with deadly organisms, has been replaced by the cleanly, once-used gauze sponge,—the bone and wooden handled knife by the one-piece metal instrument—the kitchen table and sitting-room lounge by the metal and glass structure with its convenient mechanism. The bed-room and sitting-room in the home, and the amphitheatre in the college with its revolving table, used alike for the dissected cadaver and the patient undergoing surgical operation, has been displaced by the microbe-proof operating arena with sterilizing apparatus, glass cases for the deposit and care of instruments, perfect ventilation and lighting. The operating surgeon in his linen duster with his assistants in shirt sleeves have been banished, and in their places are the surgeon, assistants and nurses enrobed in white, with masks, hands thoroughly scrubbed and rubber-gloved, with trimmed finger nails freed from microbe accumulations. The unbathed patient, in possibly street-walking garments, gives place to the scrupulously bathed and appropriately robed patient, with operating field cleansed with microbe destroying agents. Thus equipped, the surgeon enters any cavity of the body with impunity and attacks with expected assurance of success morbid conditions involving organs and parts heretofore beyond his power to assault—safe through his ignorance.

In our country, antiseptic surgery was to a certain extent a plant of slow growth. Learned teachers of surgery in our colleges, some too old to accept readily new things, some too young to appreciate its far-reaching importance and grasp its power, and still others doubtful as to its true value, referred to it as something new and to be proven. It happened at the introduction of the system of Sir Joseph Lister that the writer was one of the corps of lecturers in the Summer School of Jefferson Medical College. The subject he taught was practical operative surgery, and he endeavored, to the best of his ability, in his course of instruction, to teach the principles of this great system. In his hospital practice in St. Mary's Hospital, Philadelphia, in association with his colleague, Dr. W. W. Keen, he practiced antiseptic methods of treatment, employing the crude carbolic oil putty as a surgical dressing. It is believed that this practice of the antiseptic methods of treatment by Dr. Keen and the writer was the first carried out in the city of Philadelphia. Despite the warning sent to the writer by the learned professor that he must cease teaching the so-called new fangled and harmful system, he continued to teach the subject, and was greatly gratified to know within a year's time, that the messenger who had conveyed the injunction issued, was as enthusiastic and earnest an advocate of the system, both in his lectures and practice, as the writer.

Such is a simple description of the old and the beginning of the new in surgery, as experienced by the writer in the period of time set apart. He has endeavored to place on record events which have come under his own observation and which show not only the conditions which then were in existence and with which the surgeons of the day wrestled heroically, but those which exalt to the pinnacle of successful endeavor the achievements of to-day. In the ranks of the practitioners of surgery in those days there were stalwarts, men of resource, men of courageous convictions. With the facilities then possessed it was indeed a battle to win success against an enemy ever present, but unknown and concealed.

To-day the patient requiring surgical treatment, enters the hospital, private or public, constructed upon methods the most modern, and with full equipment for perfected work; from the door of entrance he passes from department to department, submitted in each to critical examination, and finally reclines upon the operating table, a transparent body into and through which the eye of science has penetrated, revealing the hidden morbid conditions, the significance of which the trained intellect of the expert has fathomed. At the operating table stands the surgeon with complete record in brain and knife in hand, to prove its accuracy and reveal it to the naked eye. With deft touch he excises morbid masses, shapes and fashions parts, reconstructs organs and restores halted function. Thus reconstructed, the patient emerges from the modern hospital a faultless specimen, illustrating the high art of the master hand.

And what is the future of surgery in the coming half century? Has the climax of surgical technic been reached? Is the earnest worker in surgical science satisfied with the present state of diagnostic precision? Is there not a large and inviting field for pathologic research? The work in this direction has already begun, and in the list of our Fellows there are able and zealous workers laboring to unravel the entangled problem of the abnormal, the abortive cell,—to devise the means of retarding the action and checking the growth of the over stimulated cell,—to so control cell development and cell growth that homologous and heterologous formations will have no lodgment in the tissues and organs of the body—to formulate, may we not say, the proposition of preventive disorders which find their relief, too often unsuccessful, in the knife of the surgeon? Will organ substitution, the replacement of a diseased organ by one in every respect in a state of health, find a legitimate and established position in surgical art? Will the operative surgeon enlarge his sphere of action and become as well the constructive surgeon, doing the combined work of architect and builder? Are these the fantastic images of a prophetic vision? The history of the development and growth of surgery in the past gives reality to our expectations and hopes of what the future may unfold, and is this, in truth, not the great work of the surgery of the future?

SUDDEN DEATH: A STUDY OF CERTAIN CASES OCCURRING DURING PHYSICAL EXERCISE OR PSYCHIC SHOCK.*

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About two years ago, a gentleman apparently in superb health, well known and much beloved in Boston, dropped dead while playing hand-ball. This event and the subsequent autopsy, both of which will be later described, brought vividly to the writer's attention the subject of unexpected sudden deaths, and this brief paper is a summary of observations made since that time. The first question involved was whether it is possible for a practitioner to foretell such a calamity in an individual patient, and if so to prevent or at least postpone it; the second inquiry seeks to determine whether the meagre information obtained can be utilized by the surgeon. The obvious difficulties surrounding the subject make it impossible to offer a final decision, based on a sufficient number of facts scientifically observed, in relation to either of these questions; but certain suggestive and frequently recurring features seem worthy of consideration.

Definition.—For the purpose of this paper, sudden death is defined as a phenomenon unforeseen, due neither to trauma nor to poison, whose duration is measured by minutes, and whose subjects in a vast majority of instances are supposed to be free from organic life-threatening disease.

Frequency.—Within the past two years the writer has collected from the medical and lay press, from medical examiners, and from other sources statistics of more than two hundred sudden deaths. This number represents by no means an exhaustive or thorough search for these fatalities, and is probably not more than one-half the total number which actually occurred during this period in the northeastern section of the United States.

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* Read before the American Surgical Association, June 5, 1909.

A small proportion of these notes include autopsy records and a somewhat larger number are accompanied by personal interviews with, or letters from parents, relations, friends, or eye-witnesses. The ideal record of a sudden death would include an accurate and complete previous history (and if possible a physical examination), and an autopsy made by a competent pathologist. Unfortunately, both of these sources of information are absent in a large majority of cases, and when one is available, the other is almost certain to be missing.

The records of medical examiners or coroners' physicians should be and are numerically our chief sources of information; but even these usually lack a thorough previous history, and an autopsy is permissive only in cases which are non-traumatic. In fact when sudden death seems, in the judgment of the examiner, due to "natural causes," an autopsy need never be made; and this is the precise class in which we are most interested, and the sources from which we could learn most are thus unfortunately greatly limited at the very fountain head. In spite of this, however, the figures are sufficiently large to be impressive.

Draper ("A Text Book of Legal Medicine," 1907) gives the following figures for sudden deaths due to "natural causes":

STATISTICS OF MEDICAL EXAMINERS.

Ferrario and Sermoine of Milan observed......	1043 cases
Westcott, coroner for Middlesex district, London, in 1000 consecutive deaths which were the subject of inquest, saw due to "natural causes"	303 cases
Draper himself, from 1877 to 1903, saw......... (of which 475 came to autopsy).	1850 cases
Brouardel ("Death and Sudden Death,") refers to .... and says that "the two groups of infanticide and sudden death together constitute two-thirds of the medicolegal autopsies made in France annually."	1000 cases
The writer has collected, apart from the above, notes upon	225 cases
Total	4421 cases

No further argument is needed to demonstrate the fact that these unfortunate incidents occur with rather surprising frequency.

Causes.—Draper enumerates thirty-three causes, many of which might be subdivided into several distinct conditions; Brouardel gives no less than seventy causes. Among these, however, are many which would be eliminated for practical purposes in deaths limited to the class considered in this paper; such are pneumonia, Bright's disease, alcoholism, cerebral hemorrhage, peritonitis, meningitis, pericarditis and similar diseases. It is true that these may at times be ended by a sudden death, but it is only infrequently "unforeseen" and seldom within our accepted definition of time. Even cerebral hemorrhage is in the very great majority of cases a cause of death measured by hours rather than minutes (Loomis, Draper), the rare exception being when the medulla is the site of the lesion.

Within the definition of this paper the common causes of sudden non-traumatic unexpected death are: status lymphaticus, myocarditis, arteriosclerosis (particularly of the coronaries), thrombosis and embolism (particularly pulmonary), hemorrhage (aneurism, pancreas), acute dilatation of heart, rupture of heart, alcoholism, valvular heart lesions.

To these must be added, as exciting causes or conditions: severe or unusual exertion, moderate exercise, fright or intense emotion.

Age.—Sudden death is more frequent after the age of 40 than before, and much more frequent after 55 years. Yet the number under 30 is considerable, and youth and even childhood is not entirely exempt. Percentages are difficult to obtain, but it is probably well within the truth to say that less than one-quarter of the sudden deaths occur before the age of 40.

Conditions Present.—It has been already noted that autopsies in these cases are all too infrequent, and that complete previous histories are almost unknown; in addition to this, it is a fact that a certain percentage of deaths occur in which even an autopsy fails to discover the cause. Brouardel places this percentage at 8 to 10. It becomes therefore all the more important to study the *conditions* under which sudden death occurs, and which seem to be its immediate exciting cause; if we find certain conditions preceding death with considerable regularity and constancy, it is fair to infer that these conditions play an etiological rôle, and should therefore be studiously avoided, or if this be beyond our power, should be diminished indefinitely towards the vanishing point.

In the 225 cases collected by the writer, these conditions have been noted with some approach to accuracy. They may be roughly classed in four groups: (*a*) severe or unusual exertion; (*b*) moderate exercise, or habitual non-laborious occupation; (*c*) quiet, rest, sleep; (*d*) fright, surprise, intense emotion, psychic shock.

These again are of necessity relative terms, since severe exertion for one might be moderate exercise for another; but if translated always in reference to a given individual, they become as definite and arbitrary as any we can hope to obtain. The essential point to be considered in each case is whether the condition is something usual or unusual for the individual, something to which he is or is not accustomed. Beyond this, however, there are certain other qualifications; some exercises are always severe, no matter who may undertake them; such are racing, high mountain climbing, struggles with men or beasts. Indeed, simpler forms of exercise may at one time be severe, at another distinctly moderate: for instance, in one case a drummer marching with his band falls dead while beating his drum; if this were a hot day after a very long march, it should be classed as excessive; if it were at the beginning of duty it might fairly be called moderate.

In examining these 225 cases, it became evident that a very small percentage of deaths occurred either during or immediately following extremely severe exertion; this seemed at first paradoxical until it became evident that in very many conditions predisposing to sudden death, extreme exertion, particularly of a sort often repeated, would be impossible; this is particularly true of school and college athletics, and apparently explains the infrequency of non-traumatic sudden deaths in athletics throughout this country in spite of the enormous number of boys and men who indulge in strenuous sports.

Applying this classification to these 225 cases, the exciting cause or condition seems to be: (*a*) severe or unusual exertion in one-fifth; (*b*) moderate exertion in about one-fourth; (*c*) deep emotion or psychic shock in a little less than one-fifth. The remaining cases, about one-third of all, occurred during conditions of rest or sleep.

In reviewing the 225 cases, the chief difficulty has been in the choice of illustrations, as the number is almost indefinite.

CASES ILLUSTRATING SEVERE OR UNUSUAL EXERTION.

CASE I.—A gentleman of 50, of excellent habits, strong and athletic and a powerful swimmer, was playing hand-ball with a friend; just after a rally, he dropped to the ground and died immediately, without struggle or outcry. An autopsy showed arteriosclerosis and myocarditis, cardiac hypertrophy but no dilatation; the pathologist stated that this condition might well have been impossible to detect ante mortem, even by an expert. This gentleman was accustomed to take long swims in the ocean, to climb mountains, to play hand-ball, and was the last man that would be associated in the minds of his friends with organic disease. It later appeared that he had been seen to turn pale under severe exertion, and that on one or two occasions he spoke of a sense of oppression across the chest. It would seem, therefore, that the closest attention must be paid to the history of such experiences, as well as to auscultation and percussion, if in the future we are to detect cases whose essential lesions are myocardial or arteriosclerotic.

CASE II.—A powerful farmer was attacked by a mad bull; he defended himself by great exertion for nearly an hour, holding on to the bull's horns, and being violently thrown and tossed around. He was finally released, walked a short distance to his home, and fell dead at the door.

CASE III.—In 1877, Renforth, a celebrated oarsman, fell over during a fiercely contested four-oared race, at St. John, N. B. He was removed from the boat, and died in a short time. Autopsy showed a hypertrophied but otherwise normal heart and an intense engorgement of the lungs, which did not collapse on exposure to the air.

CASE IV.—Within the past year, two young men have died either during or immediately following a Marathon race.

CASE V.—A school-boy, 16 years old, was competing against a rival school in track games. He had already raced four or five times, and entered the quarter-mile run, which was bitterly contested. At the finish he staggered and fell, and died immediately; his face was cyanotic and pupils widely dilated; the examiner did not make an autopsy, but called the condition "overstrain of heart."

It is an interesting fact that in a considerable number of cases in which cardiac disease is either recognized, or strongly suspected, the individual successfully withstands severe exertion, only to succumb, at a later period, to exercise more moderate.

A young college student, whose physical condition was supposed to be satisfactory, was a candidate for the football team; one day, before the regular practice, he ran a few steps and kicked the ball, returned to the sidelines, and fell dead. It was later discovered that his brother had died suddenly a few years before, and that this young man had been warned to beware of severe exercise; he had indulged in such exercise with but slight moderation, and had never experienced distress; but he died after an amount of exertion which was distinctly trivial.

A step beyond this is illustrated by a young man known to have a severe mitral incompetence, and prohibited by his doctor from taking part in any severe sport. In spite of the warning, he played both baseball and football; his friends testified at a later date that they had often seen him seriously distressed in both games; pale, very short of breath, and obviously exhausted beyond the condition of the average boy. He graduated from active sports and entered business. One morning, after breakfast, while in apparently excellent condition, he stopped for a moment to light a cigar while walking to catch a train; he was going up a very moderate incline, and was seen to fall; he died in a few minutes, without a sound or a struggle. This would seem to show that the excitement and nervous exaltation accompanying severe competitive athletics have a stimulating effect upon a damaged heart, and at times prevent it from stopping under a strain far greater than that to which, at a later period, it finally succumbs.

CASES ILLUSTRATING DEATH DURING MODERATE EXERCISE.

A man in apparent good health is mowing his lawn and drops dead.

A man who has not missed a day's work in twenty-one years drops dead while driving through the gate of the mill at which he was employed.

Another drops dead while shaving.

A milkman, delivering milk, falls dead at the door of a customer's house.

A man playing golf dies while hunting for a lost ball.

A farmer apparently in the best of health drops dead while driving his cattle home.

In all these cases the exertion is very moderate, and has been a habit for years.

Cases Illustrating Psychic Shock.—These cases are also numerous and interesting. Stephen Douglas, the son of the great rival of Lincoln, died suddenly; a few hours before, on its fiftieth anniversary, he had delivered a speech on the exact site where his father had contested the great issues with Lincoln.

A large number of deaths occur during speech-making: a noted temperance orator, in appealing to a youthful audience, came to the front of the platform and said with great earnestness: "Young men, take care of your records," and fell dead.

An old soldier, speaking at a reunion of a dead comrade whose vacant chair stood near him, became greatly affected and said, "But in the end the vacant chair always conquers," and fell dead beside it.

A Rabbi praying, a minister preaching, a penitent listening to a lecture on death, die without warning.

An apparently healthy boy runs to see a fire engine; just as he reaches the door of the fire house, the engine unexpectedly dashes out directly at him, but without touching him. He dies immediately, and autopsy shows status lymphaticus.

A sturdy farmer sees his son cut to pieces in a mowing machine, and falls dead; his son recovers.

A young woman sees her uncle step from a train and fall dead, and she falls dead beside him.

Such cases, always dramatic, could be enumerated almost indefinitely, to emphasize the fact that emotion is very often a potent factor in originating the processes which result in sudden death.

It is obvious, therefore, that emotion, exercise, and exertion are very frequently the exciting cause of sudden death. And a moment's consideration reveals the fact that these are precisely the conditions preceding and accompanying the average surgical operation. The apprehension and fright are very obvious, while the effect of the anæsthetic upon pulse, respiration, skin, and kidneys is precisely that of moderate exercise; furthermore, the effects of long-continued and very serious surgical interference are again precisely analogous to very severe exertion. We have, therefore, in the routine of modern surgery, reproduced with considerable accuracy the precise conditions under which a majority of sudden deaths occur. Is it not a fair inference that many of the all too frequent deaths said to be due to anæsthesia, are simply coincidental, and would have occurred with equal certainty under any other procedure which reproduced these precise conditions?

Sudden deaths before, during, or immediately following operation are too common, and undoubtedly many occur that are not reported. The writer has been informed of six in the past year in which with perhaps one exception neither the anæsthetic nor the operation seemed a sufficient cause. It is notorious to those who concern themselves with anæsthesia, that ether and chloroform are frequently blamed for catastrophies for which they are not wholly, or at times even in part, responsible.

The more we know of the real nature of these deaths, the better shall we be able to avoid them. Certain facts stand forth. We cannot yet predict with any certainty the individuals who are doomed to sudden death, nor the time of its occurrence, but we do know many of the pathological conditions which predispose to it, and the circumstances under which it most frequently occurs. In endeavoring to guard against it we must remember:

1. The comparative frequency of status lymphaticus. At least eight cases have come to medicolegal autopsy as the result of sudden death in Boston within the past year, and in the experience of only two medical examiners. Another has been withheld from operation by the skilful diagnosis of a physician; another died shortly after a simple circumcision. It is believed that the diagnosis can often be made in advance by attention to the possible presence of a thymus, bowing of the femurs, a thick, short neck, and, in men, pubic hair of the female type. Of the eight cases upon which autopsy was done six died almost instantly, and two some hours after a slight injury was received.

2. The invariable necessity for a more thorough and complete physical examination and personal history before operations even of a minor character.

3. The importance of diminishing to a minimum preanæsthetic fright, apprehension, and intense emotion, for the

sake of the patient's safety as well as comfort. (Dr. Crile has reported an admirable method of doing this in thyroid cases.)

4. The very great importance of complete histories and autopsies in every case of sudden death, an end which can be best attained by securing the active co-operation of medical examiners and coroners' physicians.

5. The necessity of the careful report of every case of operative sudden death, even if no autopsy is obtained, by the surgeon in charge of the case. It does not seem essential that such reports should be originally presented to the world at large, but they might well be made to a small committee of this Society and by them examined and analyzed, and the essential facts brought to the attention of the medical public.

Dr. Blake would greatly appreciate any notes of sudden deaths of the character above described, which have occurred under the observation of the members of the Society.

THE TREATMENT OF TETANUS BY CHLORETONE.*

BY WILLARD HUTCHINGS, M.D.,

OF DETROIT, MICH.

THE indications presented by a case of tetanus are: First, to remove the source of toxin supply. This can be accomplished by thorough local disinfection or by amputation. Secondly, to neutralize the toxin present in the circulation which has not yet combined with the nerve cells. This is done very well by the injection of sufficient quantities of antitoxin. And this is all antitoxin will do. There are no theoretical grounds for belief and no clinical evidence to show that it affects, in any way, either the growth of the germ or the nerve cell-toxin combination. Thirdly, to keep the patient alive until the body can overcome the effects of the toxin which has already entered into combination. Death in a vast majority of cases results from one of two causes. Either the amount of toxin is so large or so active that it directly affects a weak heart or the vital centres in the medulla, the patient dying in a few hours; or death results from exhaustion following the prolonged and severe muscular contractions. Practically all the former class will die. It is in the latter class, those which die from exhaustion, that treatment is more hopeful.

The object here is to control the muscular contractions, for it is as the result of these, directly or indirectly, that the patient dies. Directly, a prolonged severe convulsion may prevent air entering the lungs, the patient dying of asphyxia. Indirectly, prolonged violent muscular action produces greatly increased amounts of poisonous katabolic products which must be eliminated. At the same time, elimination by the lungs, the intestines and the kidneys is interfered with. Together with this, it is also frequently impossible to give sufficient nourishment. This unfortunate combination soon leads to a fatal issue. Provided the muscular manifestations can be controlled, we can prevent the increased katabolism, aid the eliminating organs to free the body of toxin and give sufficient food to maintain the strength of the patient. To this end a number of agents have been recommended. Some time ago, in conjunction with Dr. Charles T. McClintock, I began a comparative experimental study of the various methods of treatment which have won a recognized place in tetanus therapy. As the result of these experiments, we became convinced that chloretone was the best substance which had thus far been employed for the purpose of controlling the muscular manifestations of the disease. I have had the opportunity of treating six cases of tetanus which have been referred to me by this method with five recoveries. Of these, one was mild; one moderate; three severe and one fulminating. They are as follows:

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Case I.—Hungarian, 26 years old. Admitted to St. Mary's Hospital December 13, 1907. Seven days before admission, six before the appearance symptoms, he crushed the distal phalanx of the middle finger of the left hand with a hammer. It was washed with water and wrapped in a clean cloth. He did not consult a surgeon and no further dressing was attempted. On the morning of the 13th he complained of stiffness in neck, inability to open his mouth and pain in his back. This condition became worse during the day and that evening he was removed to the hospital. He was given 1500 units of antitetanic serum every twenty-four hours together with large doses of morphine, chloral, and bromides. Despite this treatment, he became worse. I first saw him at 7 P.M., December 17. At this time he was in marked tetanus. Clonic convulsions were frequent and severe, opisthotonos being marked. He could separate the teeth ½ cm. and could swallow. Thirty grains of chloretone dissolved in one-half ounce of whiskey were given per mouth at 8 P.M. At 8.15 he was sleeping naturally with all his muscles completely relaxed. The jaws could be opened to their fullest extent. Vigorous palpation, loud talking, and the flashing of an electric light in his eyes caused no response. He remained sleeping quietly until 1 A.M. of the eighteenth, when he awoke. The previous symptoms returned but were not so severe. Twenty grains of chloretone in whiskey were at once given. This kept him quiet most of the time until 1 P.M. He could now swallow freely, and took nourishment readily. He had no return of the clonic contractions. From this time the tonic contractions gradually lessened. He was able to open his jaws freely on the twenty-second and on the morning of the twenty-third ate dry toast, chewing it well. The finger was amputated on the eighteenth. He received 1500 units of serum and 30 grains of chloretone daily until the twenty-second, when they were discontinued. At 4 P.M. of the twenty-third, the patient complained of severe pain in the abdomen, and the temperature, which had been normal since the nineteenth, went to 103 with pulse of 140. He became rapidly worse and died at 6 o'clock the morning of the twenty-fourth. During this time there were no symptoms of tetanus.

Autopsy showed a perforation of the colon near the splenic flexure, and general peritonitis. Cultures from the peritoneal exudate and heart blood showed a streptococcus. This patient had recovered from tetanus and all treatment had been suspended. He undoubtedly died as a result of the peritonitis. Cultures from finger were negative for tetanus.

CASE II.—Female, unmarried, 23 years old. Had an abortion performed May 11, 1908, at 3 P.M. Did well until May 17 at 6 P.M., when she noticed that she moved the jaws with difficulty. This became worse, and on the eighteenth she could take no solid food, and swallowed fluids with difficulty. Her condition became worse on the nineteenth, when she had her first clonic convulsion. These increased in frequency and severity until the twenty-second, when she was removed to St. Mary's Hospital. I first saw the patient at 10 A.M., May 22. At this time she showed well-marked tetanus. The muscles of the entire trunk were in tonic contraction—limbs not affected, head drawn back, muscles of mastication rigid; could open mouth ½ cm., and was unable to approximate chin to sternum. Clonic convulsions were frequent and severe. An attempt to examine the patient's abdomen caused a violent convulsion lasting one minute. She was at once taken to the operating room and curetted under chloroform. An emulsion of these curettings injected into 350 Grams guinea pigs caused death from tetanus in six days. While under the anæsthetic, a stomach tube was passed and 30 grains of chloretone dissolved in whiskey given. This was almost immediately regurgitated. Two thousand units of the antitetanic serum were given subcutaneously and 2000 intravenously. On recovering from the anæsthetic, she was unable to swallow, and all previous symptoms returned. Thirty grains of chloretone dissolved in hot olive oil were given per rectum and retained. One hour later, the patient was sleeping quietly, all muscles were completely relaxed while the mouth could be opened to its fullest extent. She remained in this condition until the following morning, when there was some rigidity of the abdominal and neck muscles. She could open the jaws about 1½ cm., and took nourishment readily. An attempt to test the patellar reflex caused several slight convulsions. The dose of chloretone was repeated. Within 30 minutes she was sleeping quietly, completely relaxed. From this time she made an uninterrupted recovery. The chloretone was repeated every 48 hours until May 30, when it was discontinued. Three thousand units of antitetanic serum were given daily subcutaneously. During this time she took fluids readily. Four litres of saline solution were given per rectum every 24 hours. Large quantities of urine were voided voluntarily and the bowels were moved freely by large doses of cascara. She was discharged June 8, cured.

Case III.—Was a moderately severe one following a blank cartridge wound of the hand. The incubation period was 10 days. This case yielded perfectly to treatment as outlined above and was discharged cured.

Case IV.—Pole, male, 24 years. Was admitted to Harper Hospital May 28, 1908, for a severe crushing injury to left hand sustained in manipulating a bread-mixing machine. The soft parts, particularly on the palmar surface, were badly lacerated. No bones were broken. After disinfection with soap, alcohol, and bichloride, the bleeding vessels were ligated with catgut, and the parts approximated with catgut and silkworm sutures. Infection followed, and a large portion of the flaps sloughed. On June 15, the necrosed integument and portion of three fingers were removed. At the same time, a skin flap from the abdomen was sutured to the dorsal surface of the hand, the arm being retained in position by bandages. On June 22 this flap was removed from its attachment. On June 29 a similar flap was applied to the palmar surface of the hand, and on July 6 this was removed and the abdominal wounds sutured with catgut. The patient did well until July 15, when he complained of stiffness of his jaws and pain in his back and neck. He became worse despite large doses of morphine and bromides and 1500 units of serum. I saw the patient at 9.30 A.M., July 19. At this time he was in severe tetanus: unable to separate the jaws or swallow. Seventy-five grains of chloretone were given in olive oil per rectum. The wounds were curetted and washed with hydrogen peroxide. Cultures from these were negative for tetanus bacilli. Forty-five hundred units of serum were given intravenously. At 3 P.M. he could separate the jaws 2 cm. and swallow freely. From this time forward he had occasional clonic convulsions until July 26, when they ceased. The tonic contractions disappeared gradually, being completely absent on the twenty-seventh. Sixty grains of chloretone were given on the twentieth and twenty-third, and 30 grains on the twenty-sixth. Fifteen hundred units of serum were given subcutaneously daily until July 28, and elimination forced as much as possible. He was discharged cured August 4.

CASE V.—This was a mild case following an extraperitoneal shortening of the round ligaments. The incubation period was 12 days. She yielded readily to treatment, making an uninterrupted recovery.

CASE VI.—American, 52 years old, chronic alcoholic. On January 25, 1909, patient fell from scaffolding, sustaining an open fracture of the right arm at the elbow. This was reduced by Dr. T. A. McGraw, at St. Mary's Hospital, at 11 A.M. The case pursued an uneventful course until the evening of January 29, four days later, when he complained of severe pain in his fractured arm and in back. At 10.30 there was some rigidity of the jaws and difficulty in swallowing. During the night he received one grain of morphine and slept at intervals, complaining of pain when awake. At 7 A.M. January 30, he had severe clonic convulsions. I saw the patient at 9.30. He was sitting up in bed in a state of marked emprosthotonos. His clothing was soaked in perspiration. The muscles of the entire body except the arms were in a state of marked tonic contraction. He was unable to separate the jaws in the slightest degree or to swallow. *Risus sardonicus* was pronounced. During the five minutes of observation, he had eight severe convulsions. Seventy-five grains of chloretone in two ounces of hot olive oil were given at once per rectum, and retained. Under light chloroform anæsthesia, the wound was opened by Dr. McGraw, thoroughly curetted, washed with hydrogen peroxide and packed with gauze saturated with balsam Peru. He was returned from the operating room at 11 A.M. At 11.30 he was sleeping quietly, all the muscles relaxed, the jaws being widely separated. Patellar reflex very slight. Vigorous palpation of the abdomen caused three slight clonic contractions. At 12 o'clock, cultures were made from blood taken from the left median basilic, with the idea of determining the presence of the tetanus bacillus. Unfortunately the cultures were broken on the way to the incubator. However, two 350-Gram guinea pigs were inoculated, one with two c.c., the other with one c.c. of the blood from the same source. Both pigs showed well-marked tetanus at the end of 24 hours, and were dead at the end of 60 hours. Cultures from the wound were positive for tetanus bacillus. Forty-five hundred units of the antitetanic serum were given subcutaneously near the brachial plexus. The patient awoke at 1 P.M. and complained of pain in his arm. At this time there were no tonic contractions. He could open his mouth one inch and swallow with little difficulty. He had occasional slight tonic contractions during the afternoon, and at 3.30 received 50 grains of chloretone in one ounce of olive oil per rectum. He remained quiet until 10.15 P.M., when he began to have severe clonic convulsions. Fifty grains of chloretone in olive oil per rectum was almost immediately expelled. On account of the frequency and severity of the convulsions, he was anæsthetized and 50 grains of chloretone in 1 ounce of whiskey given per stomach tube. The effect was almost immediate. At 11 P.M. he was sleeping quietly, completely relaxed. He remained in this condition until 3 A.M. of the 31st, when pulse began to fall. At 9 A.M. the pulse was 170–180 and thready. At the same time, the respirations were 30, full and regular. Notwithstanding the administration of large quantities of saline by hypodermatoclysis and oxygen, the heart became gradually weaker. The pulse was imperceptible at 10.45 A.M. The respirations remained good until the pulse stopped, when they gradually became weaker and he died at 11.10, completely relaxed. Postmortem was not allowed.

I attribute death in this case to the direct action of the enormous amount of toxin in the blood on a weakened heart.

It has been demonstrated by animal experiments that chloretone kills by acting on the respiratory centre without affecting the circulation. It will be noted in this case that while the pulse was very bad, the respirations were only slightly affected, and that the patient died from failure of the circulation, not the respiration. If I were again confronted with a similar condition, I would bleed the patient freely, replacing the blood with salt solution. This would immediately remove a large amount of toxin and possibly prevent heart failure.

In summarizing these cases it will be seen that three of them, Cases I, II, and IV, were of the type which almost always die. Case III might have recovered; Case V would probably have recovered under any treatment; while Case VI was the type which will usually die despite treatment. It will be noticed that the muscular manifestations were completely controlled in every case by the chloretone. This is all chloretone will do. It has no effect on the toxin circulating in the blood, nor will it break up the combination between the nerve cells and the toxin, when this combination has taken place. It has the further merit of being harmless. No fatal cases following its use have been reported although enormous doses have been taken with suicidal intent. In addition to this, it is easy of administration. If the patient can swallow, it can be given by mouth dissolved in dilute alcohol. If this is not possible, it can be given per rectum dissolved in hot olive oil. I have given it this way in my later cases because its action is almost as prompt as when given by mouth, and it does not disturb the stomach. In addition to this chloretone lowers the temperature and has a slight diuretic action.

ANEURISMS IN YOUNG PEOPLE.*

BY THEODORE A. McGRAW, M.D.,

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I HAVE had two cases of aneurism in young men of 16 and 17 years of age. They were both associated with great dilatation of the heart and, in both, the arteries were soft and fragile.

The first case occurred nearly thirty years ago. I have lost the notes which I made of it at the time, but have a very distinct recollection of its main features. A country boy of 17 years, while working in the field was seized with a sudden pain in the bend of the right elbow and became incapacitated for work. He came to me a week afterwards for examination and treatment.

I found a pulsating tumor of the lower end of the brachial artery, and a great enlargement with dilatation of the heart. I could elicit no history of rheumatism or syphilis.

I operated on him and found an aneurism of the brachial just above its bifurcation, about as large as a hickory nut. It had ruptured and was surrounded by a large quantity of extravasated blood. I tied the artery above and below the aneurism. The upper ligature cut through as soon as tied, and I was obliged to tie it again higher up.

At the end of three days a secondary hemorrhage occurred from the cardiac end of the artery. The ligature had cut through the soft arterial walls. This happened a third and a fourth time at intervals of between three and four days, necessitating repeated ligation, each succeeding one from half an inch to an inch above its predecessor. I finally succeeded in checking the hemorrhage permanently by passing a pin under the vessel at its origin from the axillary and pressing its walls together by a figure-of-eight thread wound carefully and not too tightly around it. The wounds were at no time septic, and healed quickly. He left the hospital with full use of his arm, but died at his home from the heart trouble a year and a half afterwards.

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* Read before the American Surgical Association, June 5, 1909.

The second case was that of a boy sixteen years of age, from Wyandotte, Mich., who entered St. Mary's Hospital, Detroit, on June 26, 1908, and came under my care. According to the history which I elicited from himself and his mother, he had been subjected during his life to many hardships, and had worked beyond his strength. He had not been conscious, however, of any cardiac or pulmonary trouble, and had believed himself well until three weeks before his admission to the hospital, when he was seized with pain under the right knee. This was diagnosticated as rheumatism.

It was positively stated that he had never, prior to the outset of this malady, suffered from rheumatism or any other acute or constitutional disease. He gave no history of strain or injury. A few days before I saw him a pulsating swelling was noticed in the right popliteal space, and he was sent to Detroit for treatment.

On examination, I found a pale, anæmic lad with a very large dilated heart and a soft, collapsible pulse. The apex beat in the sixth intercostal space half an inch outside of the nipple. There was a loud, blowing murmur, heard equally at base and apex, and confusing both sounds of the heart. His pulse, 100 in the minute, was very soft and compressible. His temperature was 100° F.

In the right popliteal space there was a pulsating tumor filling up the whole concavity. His leg was flexed and could not be extended without pain. There was a constant pain, even when he was in bed and quiet, which radiated down the leg to the foot. His urine was normal. There was no leucocytosis. The report of blood examination showed the amount of hæmoglobin to be 80 per cent. of normal. He had no cough nor dyspnœa nor other evidence of lung complication, but was so weak and exhausted that I deferred operating until his strength could be recuperated by rest and treatment.

During the next three weeks he regained his appetite and grew stronger, but his temperature continued to fluctuate between 99° F. and 100° F. and his complaint of pain was constant.

The operation was performed on July 18, a hypodermic injection of morphine having been administered a quarter of an hour before the ether anæsthesia. Through a long longitudinal incision a cavity was opened in the ham, containing a large mass of extravasated blood. When this had been evacuated and the parts cleansed there was revealed an exceedingly thin and small aneurismal sac with a linear rent in its posterior surface. The sac was nowhere adherent to the surrounding tissues, and its walls, thin and fragile as a peritoneal membrane, were not re-enforced by fibrinous or calcareous deposit. On freely enlarging the opening, I found that the sac consisted of the whole posterior wall to the extent of half an inch. The anterior wall appeared as a groove in the tissues, extending from the upper to the lower orifice of the popliteal artery. I could detect nothing which had any resemblance to embolism, and the condition was rather that of a vessel distended beyond its tensile capacity than one that had been subjected to septic deposits and irritations.

I had thought to use the Matas method in operating, but found the arterial and sac walls too soft and thin for that procedure. The sutures cut through the tissues on the slightest traction, and the first ligature, which was tied with some force, came away in my hands. I tied the artery above and below the sac, therefore, with great care, drawing the threads together just tight enough to prevent hemorrhage. A rubber drain was inserted, and the wound closed around it by layers of catgut sutures. The drain was removed on the third day, the wound healed by first intention, and I was able, at the end of a week, to apply a weight to the foot to extend the flexed knee.

On August 18 he was sent home, walking upon a well leg and with no untoward symptoms. He died on November 14, but I did not hear of his demise until some time in December and was prevented from making a post-mortem examination. On the death certificate it was stated that he died of endocarditis.

These cases seem to me to have some importance because of their bearing on the pathology of aneurisms in young people. In both cases there was great enlargement and dilatation of the heart, without history of rheumatism or other acute disease. In both, the arteries, though apparently normal, were very soft and friable. In the second case this may have been the result of the long irritation due to the rupture of the sac, but in the first case, in which the whole brachial artery was affected, it is impossible to regard the arterial insufficiency as the result of a merely local affection. The entire absence in both cases of all evidences of arteriosclerosis, septic infection and embolism would seem to indicate that the relations between the cardiac disease and the arterial were those rather of coincident affections than those of cause and effect. The question arises whether many cardiac maladies occurring in childhood and youth may not be the result of failures in development which involve not only the heart but also the whole vascular system. We might expect to find these relations more especially in those dilatations of the heart in which the valvular affections were not sufficient in themselves to account for the severity of symptoms.

In children, with defects in development of this nature, hardships and severe labors may act as supplementary and exciting causes of arterial ruptures and aneurisms by bringing strains upon the vessels which they are not able to resist.

It is curious that the congenital insufficiency of the circulatory system which undoubtedly exists in some children has received only a very grudging notice on the part of pathologists.

Tubby states that "there exist in young people traumatic aneurisms without pre-existing inflammatory lesions of the arteries. He believed that rheumatism and syphilis, and probably alcoholism, creates in the descendants not only lesions but also congenital malformations of the arteries, which consist in a more or less complete disappearance of the elastic fibres, of the middle coat, and favors the appearance of aneurism in the fœtus and infant."

Jacobi includes among the causes of aneurism in children a congenital incompetency of the walls of the blood-vessels. This view of the etiology of many aneurisms in children finds support in a number of cases on record in which the heart is reported as normal. They are:

1. That of ARMITAGE, of a child seven and a half years old who had suffered from palpitation from her earliest infancy. She died of an aortic aneurism. The arteries on obduction, were found to be free from atheroma or roughness.

2. Wormaski's case of aneurism of the ulnar artery and palmar arch in a girl of twelve. The child had had no hereditary taint or rheumatism, and he attributed the disease to a strain received from lifting.

3. Keen's case of a spontaneous arteriovenous aneurism of the arm and also an aneurism of the chest in a girl of eighteen.

4. Rogers, a girl of ten with aortic aneurism; she had never had rheumatism or scarlet fever.

5. Ries, a girl of five, with aortic aneurism.

6. Pendel, aortic aneurism in a girl of twelve. He referred the trouble to a fall on the chest received six years before the development. We may be permitted to doubt whether there was any causal connection between the injury and the aneurism.

7. F. G. Smith. Boy of nine, with aortic aneurism.

8. Berry. Boy of fifteen, died of aortic aneurism. He had never had rheumatism, and there was no evidence of hereditary syphilis. The only sign of heart trouble was a slight thickening of the aortic valves.

9. Miguel. Boy of fourteen, died of aortic aneurism.

We may hardly assume that these nine patients with normal hearts owed their maladies to embolism, either mechanical or septic, as the conditions which cause embolism were entirely absent from their histories. Neither are we justified, in my opinion, in ascribing them to an hypothetical endarteritis, of which there is no other evidence than the existence of the aneurism itself. How far we may go, however, in referring their origin to pre-natal disturbances is as yet an unsolved problem.

If we study the recorded cases of aneurism in children, we shall find very few satisfactory data on which to base our opinions as to their etiology. Dr. Charles Pfender compiled sixty-four cases for me from the literature in the Surgeon General's library. Thirty-two of these were so meagrely reported as to give no clue whatever to previous history or hereditary influences. Of the thirty-two remaining, six gave more or less uncertain histories of injury. One case was attributed somewhat doubtfully to an abscess which ruptured into the aorta.

In nine cases there was history of previous attacks of rheumatism. In ten it was positively stated that the patients had never suffered from that disease. In view of the fact that rheumatism is an exceedingly insidious disease in children, often causing inflammation and dilatation of the heart before manifesting itself by muscular or arthritic pains, I cannot think that these figures represent, even approximately, the actual facts.

As regards syphilis, which is so generally credited with causing arterial degenerations and aneurisms, it is noticeable that in only one case, that of Wilson and Macy's, was there any evidence whatever of previous infection. Lebœuf, who is strongly disposed to regard hereditary syphilis as an important factor in the causation of arterial disease, admits, nevertheless, that he was unable to detect any signs of that disorder in his autopsies. It seems evident that the prevailing theories regarding this matter need careful study and revision.

In 5 cases aneurisms were found associated with tuberculosis; in 3 they were preceded by whooping cough. It does not appear that any of the 64 patients had had scarlet fever. Two cases were reported to have had measles and one to have had a streptococcus infection. It is impossible from these meagre data to draw positive and trustworthy conclusions.

The relations between cardiac disease and arterial dilatations are not yet thoroughly understood. Clinicians are inclined to attribute aneurisms which occur in conjunction with valvular affections to embolism. That embolism is sometimes a cause of aneurism cannot be doubted. That it is a very common factor in its production has not been proven. It is certain that in some cases acute infections like rheumatism, scarlet fever and typhoid fever and measles affect the arteries primarily, causing thickenings and erosions of the intima and inflammations of the media. Osler states that it is rare to find the arteries entirely free from disease. Even in children, small flecks of atheroma or fatty degeneration of the intima are by no means uncommon. It is not possible when cardiac and arterial diseases co-exist to distinguish those cases in which one is caused by the other from those in which the two arise simultaneously from the same infection. The difficulty in deciding as to the nature of these relations is increased by our inability to diagnosticate endarteritis in its acute stage.

Whatever symptoms occur, such as fever and pain, that it might present, are overshadowed and hidden from notice by the great cardiac disturbance. The heart disease is discovered in its early stages, while the associated arterial lesions do not attract attention until the subsequent degenerations have led to arterial dilatations. This may not occur for months or even years after the onset of the initial lesion, and often only when the artery is subjected to some sudden and unusual strain.

As regards the etiology of aneurisms in young people, we may say with some positiveness that in some cases there are congenital defects in development which are manifested by a thinness and softness of the middle arterial coats, and which render the arteries incompetent to resist even ordinary strains. We may surmise also that this condition may be due either to hereditary influences or to parental infections, but we have no data which enable us to determine with any exactness how important this factor is as a cause of arterial dilatation.

We have reason also to believe that the primary infections to which the arteries, especially, with the heart, are exposed, may induce lesions which may, in some cases, result in serious degenerations of the arterial coats and end in aneurisms, and there can be no doubt that emboli due to cardiac or other diseases may lodge in the arteries and affect them disastrously. The whole subject, however, needs to be studied *de novo* with more care in observing actual conditions and more criticism in judging the meaning of the ascertained facts.

GUNSHOT INJURY OF THE BRAIN.*

WITH LATE MANIFESTATIONS AFTER IMMEDIATE RECOVERY.

BY JOSEPH RANSOHOFF, M.D., F.R.C.S., (Eng.),

OF CINCINNATI.

Professor of Surgery in the Medical College of Ohio, University of Cincinnati.

It may be fairly asserted that abscesses of the brain present many difficulties of diagnosis, and that autopsies out of number reveal opportunities missed. That they may long remain latent is of common observation. But latency may be seeming and the result of inaccurate observation. The latter probably happens in the majority of instances. A notable exception, a case of true latency, was observed by the writer in the instance of a boy whom he trephined at the request of Dr. E. W. Mitchell for a compound depressed fracture of the frontal bone.

The patient, a lad of seven, had fallen from his bicycle and sustained a fracture in the region of the right frontal eminence. The dura was not injured. The depressed bone was replaced. The union was absolutely by first intention and the recovery unattended by any evidence of infection so far as the most careful clinical and bacteriologic observation could show. The patient left the hospital two weeks after the operation. During more than three years the boy's condition and development were in every way normal. He never missed a day at school by reason of ill health; never complained of headache, and was in every way well. In his school work he frequently led his classes. Three years after his injury he was suddenly seized with violent headache after becoming overheated at skating. He died in coma within twenty-four hours after the onset of symptoms. The autopsy revealed a ruptured abscess which had been encapsulated. It was a little larger than a pigeon's egg and in the right frontal lobe directly under the site of the fracture. The bone scar was scarcely visible.

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* Read before the American Surgical Association, June 5, 1909.

It may be of importance to note that the boy was the only child of very intelligent parents, who would certainly have noticed any deviation of health in him. It is, therefore, fair to assume that the abscess was latent during the time indicated.

The following case is that of an abscess seemingly latent for a number of years and one presenting a missed opportunity.

T. S. T. first presented himself to me June 3, 1907. He was then aged 43. Married. He has two children. The family history is negative. He has been a commercial traveller for five years. He was perfectly well until the 6th of May, 1899, when he was shot with a thirty-two calibre rifle fired at close range. The bullet entered an inch above the middle of the right zygoma. He remained conscious for a short time after he was injured and gave directions about calling a physician. He was not unconscious at any time. There was a short period of stupor which supervened about six hours after the injury was sustained and disappeared entirely after two days. From that time on he continued clear-headed. Immediately after the accident there was a paresis of the left side of the face, the arm, and the leg. This could not have been profound, as the patient got into a buggy, drove home, and alighted, with some assistance. He was in bed about seven weeks, after which time the paralysis began to improve. He was confined to the house altogether for about six months, and at the end of a year he was enabled to dress himself and go about. From that time forth he continued his business, which now was that of a stock broker. with few interruptions.

On the 1st of September, 1903, nearly four and a half years after the injury, the patient was seized with a severe convulsion associated with unconsciousness. The second attack occurred in February, 1904. Both of these occurred in a hotel room after retiring. During both of them he fell out of bed, and after the second he remained on the floor sleeping until morning. On the following days he was about his work as usual. During the following two years he had altogether four similar attacks. In

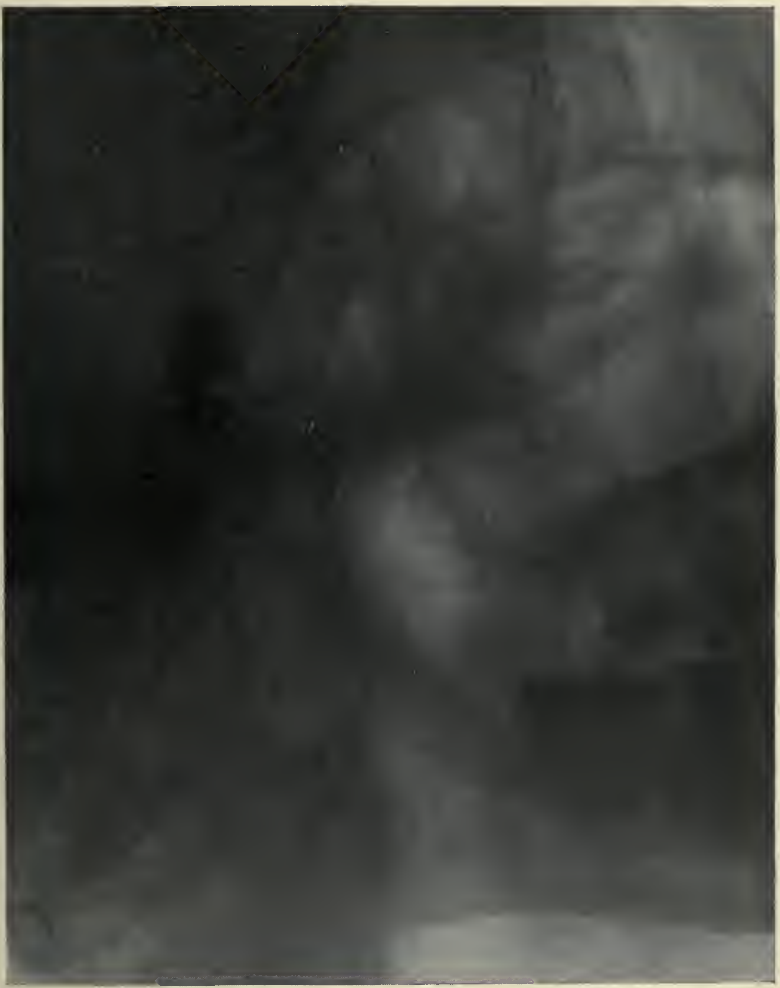
April, 1904, he consulted Dr. F. W. Langdon, to whom I am indebted for many of the clinical notes.

When the patient presented himself to me in mid-summer of 1907 with a view to operation for the relief of his epileptic seizures, his condition was as follows:

Stat. Præs.: Vigorous-looking man; height six feet; weight 220 pounds; pulse 76; heart and lungs normal; no evidence of increased intracranial pressure; no headaches at any time; ocular fundus normal; urine normal. His mental condition is normal in every regard. He is clear in his ideas and logical. There is no defect in speech, nor is there any trace of asteriognosis. The pupils act normally and the ocular muscles are unimpaired. Dr. Langdon found in 1903 a very slight weakness of the lower face on the left side and the mouth drawn slightly to the right. At the time of my examination this weakness had disappeared. Dr. Langdon also noted some dulness of taste and smell, but not localized on either side. This was not noticed in my examination. Movements of trunk and extremities normal. There is no incoordination. A dynometer test of the grasp of both hands is better than the average. The left sole is less sensitive than the right. The knee-jerks are weak but equal on the two sides. A most carful inquiry as to the history of the convulsions, of which the patient has about four a year, fails to show them to be of the Jacksonian type. X-ray plates were now taken by Dr. Thompson in anteroposterior and transverse diameters. They show the course of the bullet to have been slightly backwards, upwards, and inwards. The bullet was broken into three parts. The outer fragment was evidently in the temporal fossa and extracranial. The middle fragment was either just within or in the bony wall of the middle fossa. And the largest fragment was behind the sphenoidal sinus on a level with the cribriform plate, and it was impossible to state whether it was within the skull or not.

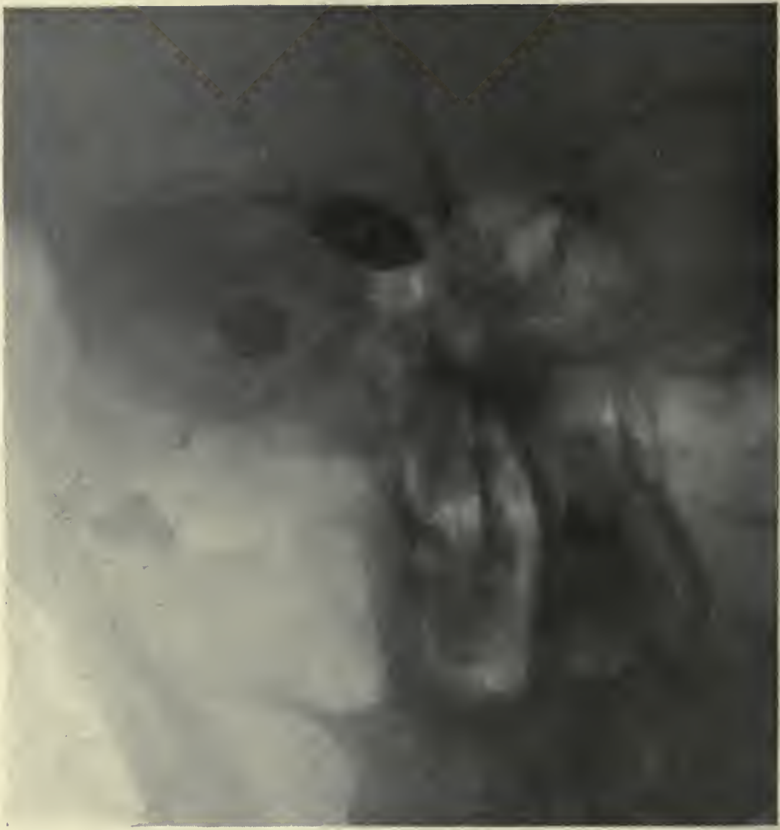
The writer believed the convulsions due to an irritation from either the second or third fragment or from a brain scar. But in the absence of any focal starting point of the convulsions, he was unable to determine which of the fragments caused them. It was natural to assume that the larger fragment was the one which, if an operation were determined upon, should have been the object of the search. Considering the excellent condition of the patient and the infrequency of the attacks, and the absence of the ordinary

Fig. 1.



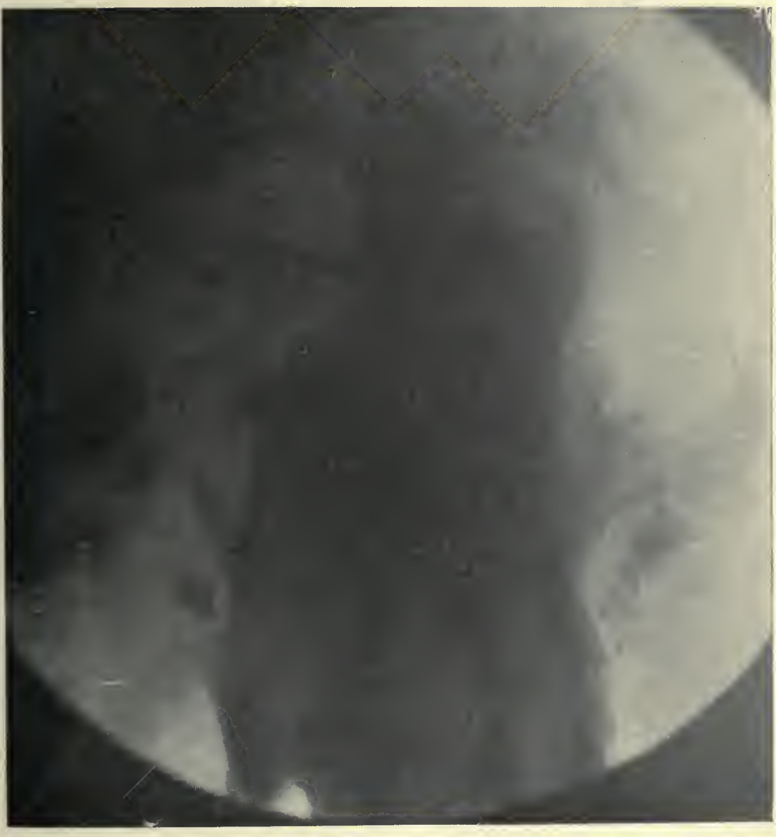
Lateral skiagram of cranium.

Fig. 2.



Anteroposterior skiagram of cranium.

Fig. 3.



signs of increased intracranial pressure, and that the attacks became less frequent under rest and bromide, an operation was not advised. The writer did not again see the patient alive.

He learns that about a year after his last visit to him there developed a paresis of the left side of the face and of the left arm. There also was noticeable a slight dragging of the left foot. While in this condition, the patient came to the city for consultation on the 20th of February, 1909. Because I was out of the city, he concluded to return to his home, seventy miles away. An engagement was made for consultation two days later. While on the train that morning, he complained of a severe headache which came suddenly after a severe jolt. When he arrived in the city the headache became intense. Shortly after reaching his hotel profound coma supervened and the patient died ten hours after the onset of the acute cerebral symptoms.

The autopsy had to be hurried and was incomplete; only the head was examined. No effort was made to find the extracranial fragment. On removing the brain the right sphenotemporal lobe was found adherent to the middle fossa and removed with great difficulty. In the floor of this fossa was a small opening the size of the end of a lead pencil. The largest fragment was firmly imbedded in the cavernous sinus between two layers of the dura mater, and without question had been innocuous from the time of its lodgment there. The brain was removed as a whole and hardened and carefully examined by Dr. Wolfstein, neuropathologist of the Cincinnati Hospital, who has given me the report which follows.

Report of Dr. Wolfstein.—Brain given me for examination by Dr. Joseph Ransohoff showed an incision in the right hemisphere on the outer lateral surface evidently made during removal. No abnormalities on the convexity of either hemisphere. At the base of the right hemisphere situated directly underneath (and ventral) to the right cerebral peduncle is an egg-shaped cavity 4 cm. in diameter. On opening this cavity thick pus poured out and then the cavity was seen to have a depth of about an inch and a quarter and to be evidently walled off from the surrounding convolutions.

The cavity occupies a position at the base of the temperosphenoidal lobe extending forwards to the uncus, in fact to the anterior extremity of the sphenoidal lobe reaching to the Sylvian fissure, separated from it, however, by a portion of the compressed thin convolution before mentioned. It also occupies the anterior third, at least, of the gyrus occipitotemporalis and impinges upon the inferior temporal convolution. The optic tract in its passage around the crus was in direct relationship with the roof of this cavity and may have been pressed upon, but does not appear in any way to be obliterated, although it does not appear to be as healthy as the tract on the opposite side. The optic chiasm, the mammillary bodies, and the third nerves appear perfectly healthy. On opening the cavity at the bottom, it extends inward into the substance of the uncus and the sphenoidal lobe as above mentioned and the wall of the cavity looks very much as if it had a pyogenic membranous lining. Lateral to the abscess cavity a firm substance can be felt, around which there is a marked fibrous thickening which is cut through with some difficulty, and encysted in the substance of this thickening a foreign body can be plainly felt. As said, it is completely surrounded by fibrous tissue.

On cutting through this tough fibrous thickening, a fragment of a bullet falls out, but it is remarkable how firmly encysted this piece of bullet was. I expected at first to find a large flattened mass of bullet, instead of which I found the tough fibrous material was five or six times the size of the bullet and in places a third of an inch thick.

On cutting away this mass, it was found that in its interior the mass was of the same consistency as cartilage. The abscess can be dissected loose without much difficulty from the structures which form its roof, and its roof lies directly under the medial convolutions of the island of Reil.

When the abscess cavity is removed completely a tongue of tissue forms its roof lying immediately ventral to the right crus cerebri. Immediately back of it can be seen the posterior edge of the right columna fornicis. There seems to be also a marked purulent infection of the overlying lateral ventricle. On turning the brain over and examining it from the top, a purulent infection of both lateral ventricles as well as the middle ventricle is very well marked.

The infection involves both the columnæ fornici and even the fibres of the upperlying corpus callosum. The tissues posterior to the roof of the middle ventricle, namely, the corpus callosum and the junction of the two columnæ fornici, are also the seat of purulent infection. On dividing these the choroid plexus appears and seems to be of a lusterless dirty hue, evidently also the seat of an inflammatory disturbance.

A secondary infection can be traced forward into the front end of the middle ventricle and along the anterior descending column of the fornix. On cutting through the cerebellum and the superior medullary velum exposing the corpora quadragemina and the floor of the fourth ventricle, it also presents the same dirty greenish appearance as above described.

In turning now to the corpus striatum on the right side, the infection seems to have extended pretty well out toward the lenticular nucleus and certainly has involved the fibres of the corona radiata in its outer aspect.

On cutting open the right optic thalamus and part of the right lenticular nucleus, the capsular fibres seem to be involved in their outer half and certainly in the passage of the fibres from the capsule into the crus they have been markedly pressed upon by the abscess above mentioned and also no doubt involved in the inflammatory process. The two crura cerebri and the upper portion of the brain stem were saved for hardening in Miller's fluid to determine secondary degeneration.

The hemiplegia (think it was left) was due either to involvement of the pyramidal tract as it passed through the capsule interna or more probably to pressure of the abscess on the right crus. As said, the optic tract was not destroyed, but there may or may not have been symptoms on the part of the visual fields due to pressure.

REMARKS.

The case reported is another illustration of the fact that the right temporosphenoidal lobe may be the silent site of an abscess. Nearly ten years elapsed between the infliction of the injury and death. Immediately after the accident there were positive evidences of impairment of the internal capsule or of the pyramidal tract. It is likely that a hemorrhage slowly coming on by pressure caused the initial stupor and left-sided hemiparesis. With the gradual encapsulation of the clot, the focal pressure-symptoms disappeared. When the infection within the exudation occurred, it is impossible even to surmise. Although it is not without parallel elsewhere, it does seem very improbable that the infection which caused death had remained quiescent during nearly ten years.

Although the term "latent" might be used in the case reported, it would, in the light of subsequent events, be misused. I reluctantly quote from Mr. Ballance, "Is it not possible that in at least some of the latent cerebral cases, the latency has been in the faculties of the observer; not in the clinical reactions of the patient."

Had the patient been carefully observed at any time during the six months preceding death, it is practically certain that a lesion of the temporosphenoidal lobe would have been recognized and relieved by an operation. Before the paralysis supervened there were no symptoms except the general convulsions which were supposed to be the result of a brain scar, or due to the presence of the fragments of the bullet. My natural belief was that the convulsions were due to irritation from the larger fragment which, on account of its position, had lodged near or within the cavernous sinus and could only be reached with the very greatest difficulty and danger to the patient. In the light of subsequent events I am certain that, had an operation been performed when the patient came under my observation in June, 1907, the abscess would have been at once encountered on opening the temporal fossa and the smaller fragment or real cause of the convulsions easily found. I am justified, I believe, in reporting this case as exemplifying an opportunity missed.

COMPLETE DETACHMENT OF THE FACIAL BONES FROM THE CRANIUM, TOGETHER WITH MULTIPLE FRACTURES OF THE SIDES AND BASE OF THE SKULL.*

RECOVERY. CONDITION AT THE END OF FOURTEEN MONTHS.

BY CHARLES A. POWERS, M.D.,

OF DENVER, COLO.,

THE following case is presented with brief comment. So far as I am able to ascertain, surgical literature presents no record of a similar injury followed by recovery.

Mrs. X., a lady of about 30 years, was thrown from her horse at 4.30 P.M. on March 27, 1908. It is probable that the horse fell on her head. She was seen by me twenty minutes after the accident, and at that time the following condition was noted. The patient was unconscious, the breathing was stertorous. The pulse was 70 per minute and of fair quality, the rectal temperature was 99°. There were moderate abrasions of the left side of the face. The patient was bleeding profusely from the nose and mouth; she was bleeding very freely from the right ear and moderately from the left ear. The face was greatly swollen and distorted. The orbital tissues were extremely swollen, protruded and ecchymosed. The features were in no way recognizable. On pressure the entire face could be freely moved from side to side and from above downward. On pressing the lower jaw against the upper jaw the face and orbital tissues showed upward. No injuries were found excepting those of the head.

Diagnosis: Detachment of the facial bones from the cranium with fractures of the base of the skull. Prognosis, very grave.

Immediate and thorough cleansing was made of both ears: the auditory canals were moderately packed with sterile gauze and copious aseptic dressings applied. The nasal fossæ were cleansed as well as possible and packed with iodoform gauze. The pharynx was washed and sprayed.

During the evening the pulse and temperature began to rise.

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* Read before the American Surgical Association, June 6, 1909.

The urine contained a moderate amount of albumin. Copious infusions of salt solution were ordered. Late in the evening the patient made a semi-response to questions. Examination of the pupils directly after the accident and during the evening showed them to be equal, moderately contracted, responding to light.

The following morning at nine o'clock the temperature was 106°, the pulse 150 and thready. Infusions of salt solution were liberally used. During the forenoon the patient replied to questions in a semi-intelligent way. During the day the temperature and pulse fell; at eight P.M. the temperature was 102°, the pulse 120. The following morning, the morning of March 29, the temperature was 100°, the pulse 90. During the time which had elapsed since the accident there had been pretty free bleeding from the right ear and moderate bleeding from the left ear. Scrupulous asepsis was maintained in the necessary change of dressings. The hemorrhage from the nose and pharynx practically ceased at about the end of twenty-four hours and frequent sprays of a boric solution were used.

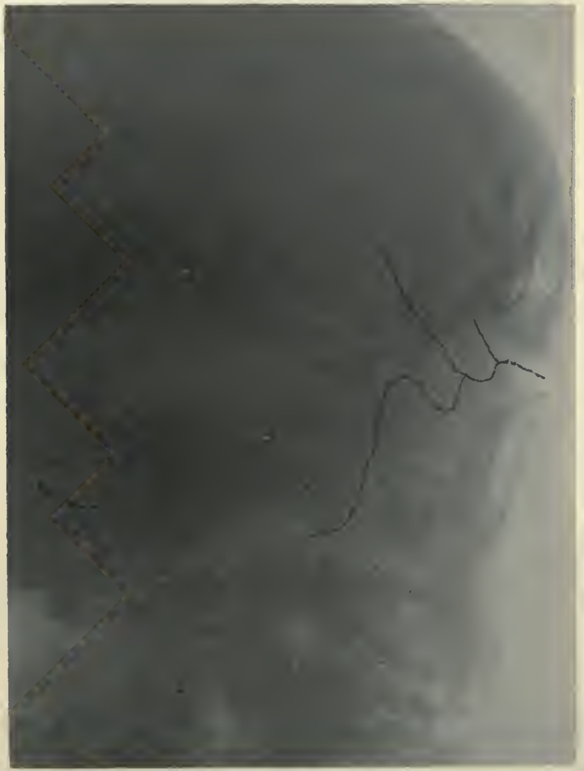
During the next few days the temperature averaged about 100°, the pulse was from 90 to 100, the mental attitude seemed to gradually improve and it was fair to assume that a condition of concussion of the brain rather than of compression had been present. At no time was there any paralysis of the extremities, the reflexes had been preserved. Forty-eight hours after the accident gentle attempts were made to mould the facial bones into place and these efforts were repeated from day to day. No retentive apparatus was thought advisable. The lower jaw seemed uninjured.

Four days after the accident skiagrams were taken by Dr. Childs. They are reproduced in Figures 1 and 2. There are doubtless other lesser fracture lines in addition to those shown. Dr. Childs's description of them is as follows:

"The skiagrams of Mrs. X., taken April 1, 1908, show the following conditions:

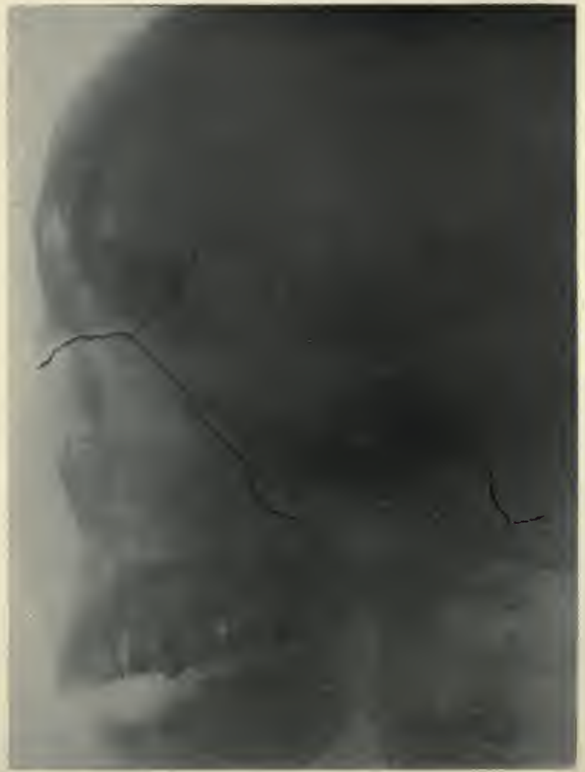
"A complete transverse fracture of the nasal bones 9 mm. distal to their articulation with the frontal bone, the fracture extending through the ethmoid and nasal process of the maxilla into either orbit. In the left orbit the fracture can be traced across the orbital plate of the maxilla and emerges near the external orbital process, thence is continued downward through the

FIG. 1.



Complete detachment of the facial bones from the cranium, multiple fractures of the sides and base of the skull. Right side. (Skiagram and tracing by Dr. Childs.)

FIG. 2.



Complete detachment of the] facial bones from the cranium, multiple fractures of the sides and base of the skull. Left side. (Skiagram and tracing by Dr. Childs.)

tip of the zygoma at its junction with the malar bone, then passes backward and downward through the maxilla and pterygoid plate of the sphenoid, terminating 6 mm. above the level of the inferior surface of the palate bone. About midway of the left orbit there is a branching line of fracture which can be traced upward through the orbit into the frontal bone.

"In the right orbit there is a stellate fracture, one limb of which passes upward through the orbital plate of the frontal and a lower limb passes across the orbit, thence through the malar bone, continuing its course downward and backward through the maxilla and pterygoid plate of the sphenoid, terminating just above the level of the inferior surface of the palate bone.

"At the base of the skull there is a fracture extending backward from the petrous portion of the temporal into the occipital bone.

"*Diagnosis:* Complete transverse fracture of the bones in the upper part of the face, with basal fractures of the frontal, temporal and occipital bones."

On the sixth day the patient experienced a moderate chill followed by increased temperature and gradually lost the sight of the right eye. This was thought to be due to a compression of the optic nerve. Dr. J. M. Foster,[1] who assumed the care of the eyes shortly afterward, kindly gives me, under date of May 3, 1909, the following from his notes:

"I first saw Mrs. X. on the ninth day after the accident, April 4, 1908, at which time the swelling of the lids had greatly decreased, but she was unable to voluntarily raise the lids. The sight had apparently remained good in each eye until the evening of the sixth day when she noticed diminution in the left. This was accompanied by increase in temperature, rigor, and sweating. On the morning of the seventh day she was unable to see a lighted candle with the left eye. There was complete ptosis of the right side, but on the left it was not quite so marked. No facial paralysis. Conjunctiva was congested, slight mucous secretion. Each eye-ball was absolutely fixed, no motion in any direction, marked bulging outward. The pupils were slightly dilated, the right sluggish, the left immovable. The right disc was slightly blurred on the edges, vessels normal. There was a grayish pallor over the entire retina. The left disc was quite pale, vessels contracted, especially the arteries, and grayish color around the disc and the macula. No effusion nor cherry red spot. At this time it seemed probable that the condition was the result of pressure upon the blood-vessels and nerves at their entrance to the orbit, less probably due to an embolism of the arteria centralis retinæ. V.R. 20/80, V.L. nil.

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[1] I am also indebted to Drs. Pershing, Bonney and Jayne for kind aid in the care of the patient.

"April 27, 1908. Examination showed that the condition of the right eye was practically unchanged except that the internal rectus showed slight inclination to turn the ball somewhat inward and the ptosis was less pronounced. The movements of the left eye were good in all directions and the ophthalmoscope showed a typical picture of atrophy of the optic nerve.

"On May 8, 1908, the condition continued to improve as far as the movements of the left eye were concerned. There was very little ptosis remaining and the eye moved readily in all directions. The right eye, however, had made but little change. Ptosis had improved somewhat and the power of the internal rectus was slightly greater. Vision equalled 20/70.

"On July 17, after having used the galvanic current applied directly to the muscular attachments on the right eye the past three weeks, it is found that the internal rectus and the superior and inferior recti muscles are regaining some strength, but the external is absolutely without function. V.R. equals 20/40 with .25 = -1 C. 180. = 20/30. V.L. nil.

"April 18, 1909. The ptosis of the right eye is almost overcome, but there is still slight drooping of the lid and the internal rectus has pulled the right eye into the inner angle for the past six months producing very pronounced paralytic squint. The superior and inferior recti have only regained a small portion of their normal strength. The external rectus remains paralyzed. Tenotomy of the internal rectus * followed by shortening and advancement of the right external rectus brings the eye to primary position. The hearing in each ear is normal for voice, whisper and watch."

After the first few days the patient gradually underwent improvement. She never complained of pain, she was able to be nourished, the bowels gave no trouble. At times there was a trace of albumin in the urine, at other times urine was free from this. There was a moderate cerebrospinal discharge from the left ear for a few days and a considerable similar discharge from the right ear for many days. In due course of time this completely ceased. The hearing remained good and has never been impaired. It was about two weeks before recent events became fixed in the memory.

As has been said, the facial bones were gently and carefully moulded into place. They underwent complete union at the end of five weeks. Resultant deformity is but very slight. The face is a very little dropped, the distance between the tip of the nose and the forehead is a little increased. The nose is in a straight line. There is a little prominence of the left malar bone. Articulation between the left lower and upper teeth is not quite perfect. There is perfect articulation on the right side.

Mrs. X. gradually became restored to practically complete health. At this time, fourteen months after the accident, aside from the disability of the eyes, before noted, she is in a practically normal condition.

A thorough search of surgical literature, in which quest I have had the kind aid of Dr. F. Robbins, of New York, fails to reveal a parallel case. The only observation definitely bearing on the subject which we have been able to find is the following by La Personne and Le Fort in *La Presse Médicale*, No. lxii, 1900:

Their patient was a man 26 years of age who met with an accident in such a way that his face was thrust on the ground and his head held fast for several minutes under a heavy stone. Details of the accident were not remembered by the patient, although he claimed not to have become unconscious. There were a few insignificant abrasions of the hairy scalp, while the face had borne the brunt of the injury. The nasal bones, the upper jaws, and the right inferior maxilla were separated from the remaining bones and the upper jaws could be moved from side to side and from above downward, under crepitation. In spite of these severe injuries the face healed, but not without considerable deformity, which caused the patient to seek admission to the hospital. Numerous bluish-black scars were seen surrounding the right eye; the orbit was much contracted and the eyeball was adherent to the conjunctiva on the outer side; there was paralysis of the right external rectus muscle, and internal strabismus. The root of the nose was enlarged and pushed over to the right; the right superior maxilla was flattened and sunken; there was slight facial paralysis. The lower margin of the orbit was broken through and the inner portion was 2–3 mm. lower than the outer. The skin in the region of the outer side of the upper jaw was anæsthetic.

By means of plastic procedures the patient's condition was much improved and the cosmetic deformity was corrected to a considerable extent. Ten days after the operation he asked to be discharged from the hospital, and six weeks later he was described as free from pain and having a wider palpebral slit, which began to show the eye-ball at the inner angle in spite of the marked internal strabismus.

La Personne and Le Fort say that this observation gives rise to a number of interesting questions. There were several complicated fractures and paralyses, the retrospective diagnosis of which is by no means easy. Beyond a doubt there was a large fracture involving the two superior maxillæ, separating their entire lower portion from the higher parts and the overlying bones; this transverse fracture separated the entire palatine arch from the remainder of the face. The pterygoid processes were in all probability broken off at the base and mobilized with the palatine arch, as is the rule in these fractures. The right malar bone was detached above at the level of its articulation with the frontal bone; outside, at the level of the xygomatic arch; within, it was separated from the superior maxilla; downwards and backwards, it remained adherent to the pyramid, which was shattered and penetrated in part into the maxillary sinus. Thus the malar bone, with the outer angle of the pyramid formed a second fragment, which underwent a to-and-fro motion causing the sinus wall to be pushed up from below. A third fragment was loosened in shape of the entire ascending ramus of the right maxillary, which became crowded upward into the orbit. This displacement led to very serious results: outward deviation of the palpebral slit and complete destruction of the nasal canal. It is very probable that the bones of the nose were fractured with the base of their frontal insertion, a very rare and extremely grave lesion. Moreover, there seems to have been a luxation of the right nasal bone on the ascending process of the maxillary bone of the same side, a luxation which is practically certain to be complicated by fracture. The lesions at the left orbital margin and the anæsthesia in the left suborbital region, serve to show that there was a fracture on this side; it is probable that there were lesions of a minor degree, but about symmetrical with those of the right side, in the region of the left malar bone.

THE PARATHYROID QUESTION.*

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For more than fifty years reference has been made by various authors to peculiar gland bodies that were quite regularly associated or connected with the thyroid glands.

Sandstrom's[1] excellent description of what he called "accessory thyroids" was given in 1880, and Gley[2] demonstrated later that tetany was caused by the removal of these glands in thyroidectomy. Rogowitz,[3] Christiani,[4] Zielenska,[5] and Hürthle[6] respectively described as embryonic thyroids similar bodies in various animals.

In 1895, Kohn[7] made note of four epithelial capsules to the individual, although more, or fewer have been noted occasionally.

In 1908, Welsh[8] gave us an exhaustive description of the parathyroids which he designated as, posterior superior and anterior inferior.

Moussu,[9] Vassale and Generali,[10] and Jeandelize believed that a deficiency of parathyroid secretion occurred in exophthalmic goitre, and they, with others, thought the same condition was the probable cause of various forms of convulsions.

Lundberg[12] believed that paralysis agitans was also caused by a deficiency of secretion, his theory being shown by Thompson[13] as erroneous in an examination of nine cases at autopsy. Thompson's statement is supported by other investigators.

As stated by the more careful observers, the parathyroid glands are four in number, usually without the true capsule of the thyroid gland. They are 6 or 7 mm. long, 3 to 4 mm. wide and 2.5 mm. thick. They are supplied by a terminal artery entering the hilus. The arterial supply is mostly derived from the inferior thyroid artery, or from the anastomotic branch between the superior and inferior thyroid arteries. The parathyroid glands are often designated as *superior* or *external,* and *inferior* or *internal.*

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* Read before the American Surgical Association, June 4, 1909.

There are wide variations in the effect of the removal of the parathyroids in various animals, especially the herbivorous animals, in whom the bodies may be irregularly placed at a distance from or within the thyroid, making it difficult to be positive as to their complete removal. Extirpation of the parathyroids of animals, especially in dogs, is quite regularly followed by tetany.

The association of function of the glands like the thyroid, parathyroid, thymus, suprarenal and others become more marked as continued investigation discloses the various changes consequent to disease or removal of the various glands. It is probable that some of the glands act through the hormones or chemical messengers, and that others are more reflex in effect. MacCallum and Voegtlin[14] especially mark the changes in calcium metabolism incident to parathyroid deficiency.

The pathologic changes are of simple types, *i.e.,* degenerations, hemorrhages, cysts, and seldom tumors. There are about a dozen tumors of the parathyroid reported, most of these being found at autopsy, and all were benign adenomas.

From such reports it would appear that these glands as compared with other organs and lesions are singularly free from serious diseases, especially those of a surgical nature. This explains why our information is gained principally from accidental findings incident to their injury during operation upon associated structures and from direct experimental work upon animals, thereby differing from the more recent medical advances.

The greatest progress in our working knowledge of the pathology of the body in general has come from the treatment of surgical conditions, and from a consideration of pathologic changes in the living.

In the surgery of the thyroid, not considering sepsis, we have always had reason to fear hemorrhage both primary and secondary, as well as injury to the recurrent laryngeal nerves. Must we not be watchful of the parathyroids? While the deaths from their injury will probably be fewer than those from the first mentioned condition, the character of the death with convulsive seizures seems more shocking than from any other cause.

In 1200 operations for goitre we have seen no tetany, and it is possible that certain principles of operation which were developed long before there was a parathyroid question, may have contributed to the preservation of the parathyroid bodies.

Freedom from hemorrhage, *i.e.*, a bloodless operation, has not been a marked feature, as the superior thyroid artery is usually the only large vessel ligated as it enters the gland. Other vessels are caught by many forceps as they pass through the capsule. The posterior capsule is carefully preserved in all operations upon the thyroid. We believe this technic best for the occasional or inexperienced operator, but possibly not necessary for the experienced surgeon who continuously maintains a dry wound. Cystic tumors or encapsulated adenomas are usually treated by the Partia-Socin-Billroth method of enucleation. Large colloid growths are treated by extirpation of the larger lobe and resection of the other side. When the enlargement is marked and nearly even, resection on both sides, as advocated by Mikulicz, is an excellent method of reduction.

Operations upon cases of hyperthyroidism are usually confined to one side, and the blood supply being free, there is but little danger of subsequent hypoparathyroidism.

As the removal of supposed lymph glands or small accessory thyroids is not essential in operation for goitre, we make it a rule to implant such bodies, when accidentally removed, into the capsule of the remaining lobe or in some other acceptable location in the exposed tissue of the neck. It is quite possible that the human being with four parathyroids has some to spare, and that if those on one side are preserved, no untoward consequences will follow. This phenomenon has been noted in other double structures, the kidneys, ovaries, etc. In four instances in which one parathyroid body was removed we noted no unusual symptoms during recovery.

Should tetany follow an operation for the removal of the goitres, the indications are to administer calcium salts, preferably the lactate, in 4 to 5 per cent. solution intravenously, by stomach, or by rectal enemata. This has been found most efficient in dogs, by Voegtlin and MacCallum, although Beebe and Berkeley[15] in a similar series of cases of experimental tetany were not so favorably impressed with the efficacy of the calcium as with the use of their parathyroid serum.

In experimental tetany, bleeding seems to be of temporary benefit, but it is probable that in most human beings in which it occurs, that the operation will have served that purpose.

If the above remedies can but maintain life until parathyroid glands can be secured, transplanted and function obtained, it may be possible to tide the patient over into a chronic state which may later become a cure.

In a report of cases and of experimental work, Halsted[16] reports having secured benefit not only from the use of serum, but from feeding both dried and fresh beeves parathyroids. He found it necessary, in order to secure the success of the transplanting of the parathyroids, to first cause a parathyroid deficiency. While he obtains the best results by implanting the glands beneath the posterior sheath of the rectus abdominus, others have apparently succeeded by grafts into the remaining lobe of the thyroid, into the spleen, peritoneum and other locations.

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THE HISTOPATHOLOGY OF GOITRE.

BASED UPON THE MICROSCOPICAL STUDY OF OVER FIFTY CASES OF THYROIDECTOMY, WITH HISTORIES OF THE MOST IMPORTANT.*

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MacCallum, of Baltimore, in a recent article on the pathology of exophthalmic goitre, describes certain histological changes in the thyroid gland which he regards as diagnostic of the disease. These microscopic changes he depicts as a budding or infolding of the acinal epithelium, together with certain alterations in the morphological character of the lining cells. His observations were made upon a number of cases of exophthalmic goitre, every one of them presenting the characteristic picture to a greater or less degree. Even in the very early stages of the disease the histopathological change could be made out in some part of the gland.

In view of this work we were led to make a careful comparative study of fifty or more consecutive cases of thyroid conditions, including all varieties of gland disturbances and without special reference to Graves's disease. In this way we considered it possible to ascertain whether any pathological picture characterizes the thyroid gland in exophthalmic goitre distinctively from other conditions.

Fifty-nine cases in all were carefully studied histologically. Eighteen cases were unquestionably Graves's disease, two of which proved fatal. The infolding and budding of the acinal epithelium was present in some parts of the gland in 20 cases. The gland presented tumor formation in three cases of the series, viz.: carcinoma in one, intercystic papilloma in another, and angioma in still another. Chronic inflammation in the form of lymphoid- and plasma-cell infiltration, together with an increase in fibrous-tissue stroma, occurred 29 times. Eleven cases were of a simple cystic condition. In each case many sections were obtained for microscopic study and from various parts of the gland. The tissue was fixed in Zenker's fluid, formalin, and alcohol, and embedded in paraffin. Sections were stained in eosinomethylene blue, hæmatoxylin-eosin, and Mallory's connective-tissue stain.

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* Read before the American Surgical Association, June 4, 1909.

For convenience of description the histopathological changes that occurred in this series of thyroid glands may be divided into six groups:

The *first* type is characterized by a subacute inflammation in which the supporting framework of connective tissue is infiltrated with lymphoid and plasma cells. The cellular exudate is usually focal, though sometimes it is diffusely distributed throughout the interacinal tissue.

The *second* type of lesion is distinctly proliferative in character; the connective-tissue trabeculæ and acinal framework are markedly increased. This fibrous new growth presents the essential change. Often dense foci of leucocytes, including plasma and lymphoid cells and polynuclear neutrophiles, infiltrate the areas of connective tissue. One of the striking features in this type of chronic thyroiditis is the occurrence of sharply defined collections of cells whose architecture resembles the so-called "tracoma bodies," or even the lymph nodes. Encircling these bodies are dense collections of mononuclear lymphocytes. The cells comprising these bodies are 10–12 microns in diameter and possess a single ovoid vesicular nucleus and pale-staining granular protoplasm. Whether the cells are of endothelial origin cannot be definitely stated, though in our opinion it would seem to be the explanation.

The *third* type of lesion is characterized by vascular changes. These usually take the form of an obliterating endarteritis, though in some vessels the lesion appears as a degeneration especially of the media. Thrombosis is occasionally seen. There is often associated with the vascular changes a well-marked perivascular increase in fibrous tissue. With this type of lesion hemorrhage into the acini is frequently encountered. The most interesting change, however, occurs in the gland epithelium. Here large areas of the parenchyma undergo necrosis, but the individual cells lining the alveoli remain intact; the picture is analogous to an extensive focal necrosis of the liver. The destruction undoubtedly results from occlusion of the vessel supplying a particular area, in which the occlusion is either endarteritic, thrombotic, or both.

A *fourth* group of changes includes the neoplasms, such as carcinoma, intercystic papilloma, and angioma.

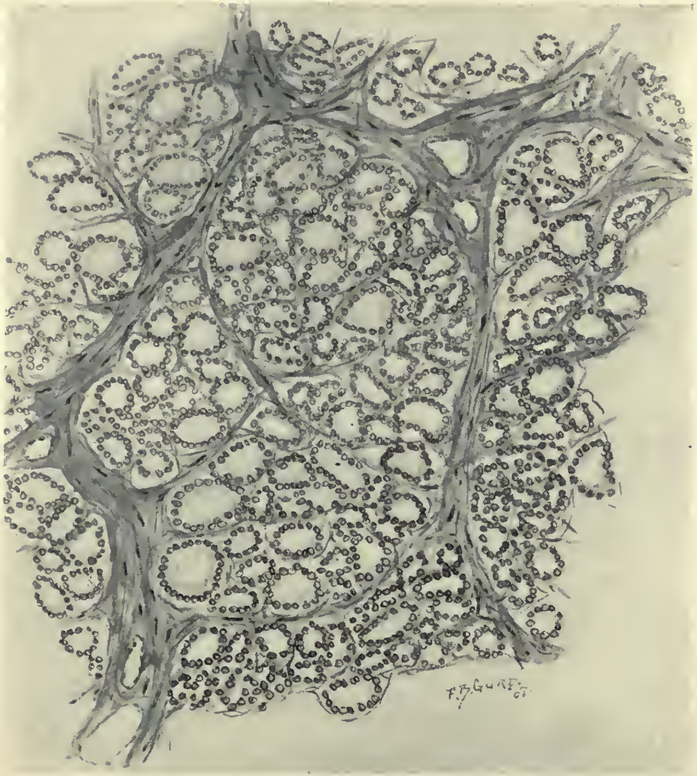
The *fifth* type consists of an interstitial cellular (interacinal) hyperplasia which in many ways resembles a sarcomatous growth. Though the acini are apparently unchanged in size and structure they are uniformly separated by the enormous cellular increase in the tissues interposed.

The *sixth* type is represented by distinct hyperplasia of the gland parenchyma, which results in more or less tortuosity of the alveoli and infolding of the epithelium, the degree largely dependent upon the amount of colloid substance within the lumen.

The microscopic study of a large number of sections from each specimen of gland showed neither cellular arrangement nor cytological changes ordinarily detected by routine staining methods which could be regarded as specific for any special type of disease of the thyroid gland. Though infolding and budding of the acinal epithelium occurred in the gland of exophthalmic disease, the histological picture, however, was not at all constant. Occasionally infolding of the alveoli is entirely absent in unquestionable cases of Graves's disease; while, on the other hand, infolding and budding of the alveolar wall frequently occurs in simple goïtre and other benign conditions of the thyroid gland in which there is hyperplasia.

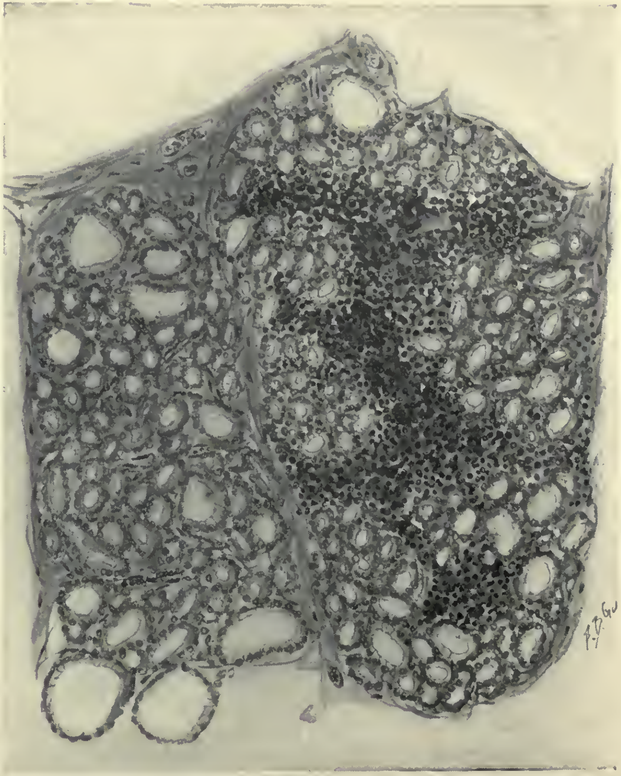
In our series of examinations five pronounced cases of Graves's disease failed to show the slightest suggestion of infolding of the gland epithelium, though many sections and from all parts of the specimen, were examined. Again, in our cases we encountered a number of cystic goitres and glands,

Fig. 1.



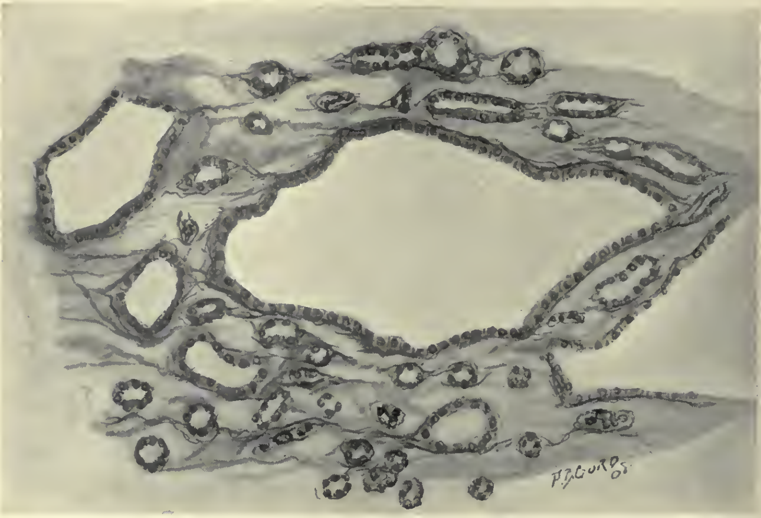
Normal thyroid gland.

Fig. 2.



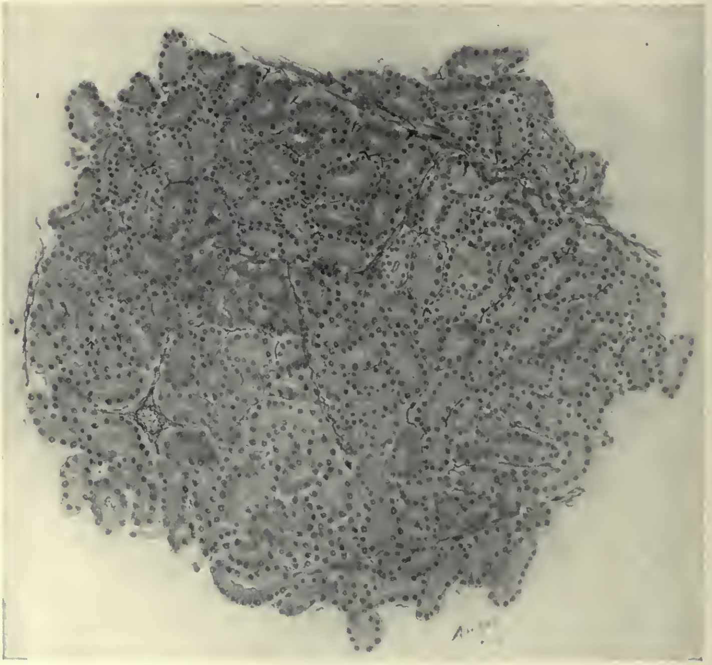
Chronic inflammatory globule infiltrated with lymphoid cells.

FIG. 3.



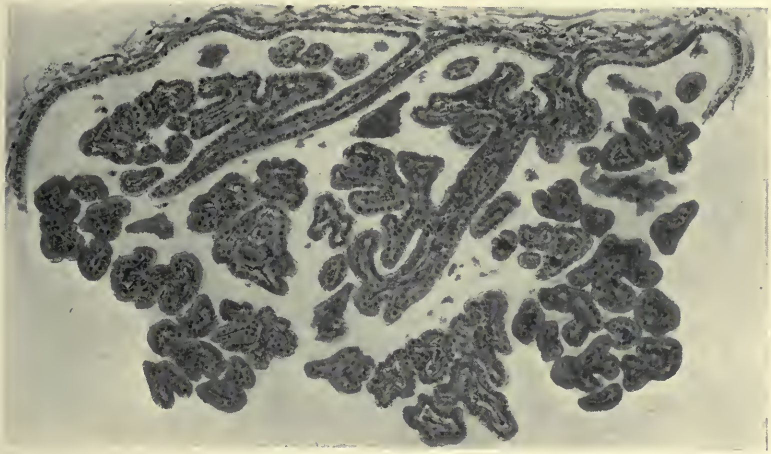
Cystic thyroiditis.

FIG. 4.



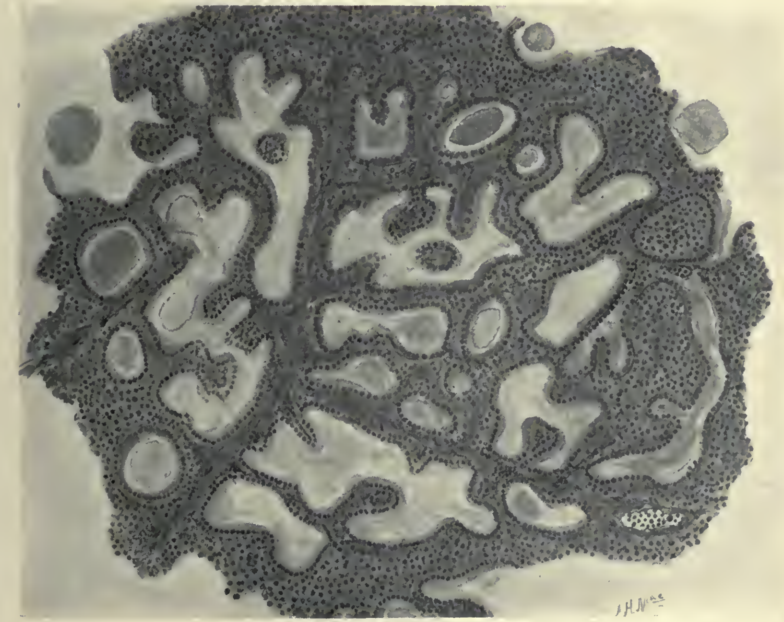
Adenocarcinoma.

Fig. 5.



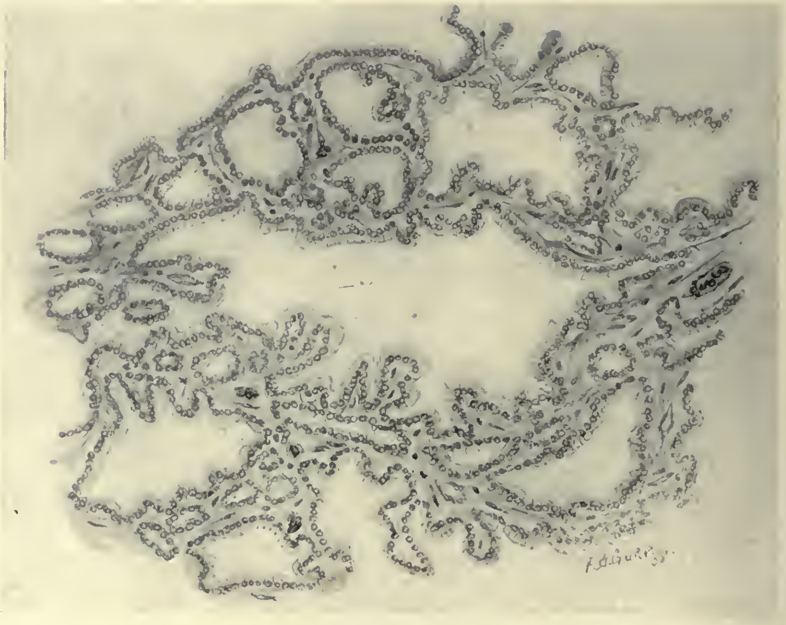
Intracystic papilloma.

Fig. 6.



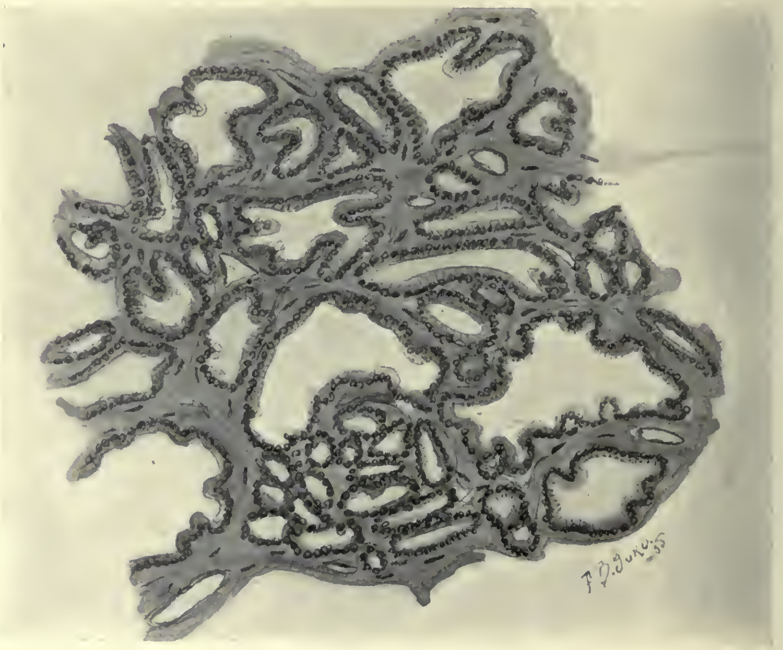
Interacinal hyperplasia.

Fig. 7.



Marked glandular hyperplasia, showing infolding and budding of the acini. *Not* a case of exophthalmic goitre.

Fig. 8.



Slight hyperplasia (infolding and budding). Fatal case of exophthalmic goitre; not operated upon.

the seat of extensive neoplastic growth, that presented the perfectly typical picture of infolding and budding of the parenchymal cells.

Alterations in the morphological character of the epithelium—for example, several layers of cells lining the alveolar walls, the flattened type of cell becoming columnar, the change in chromatin-content of the nuclei, etc.—we have not found constant for any one pathological condition of the thyroid gland. Whether the lining epithelium of the gland is columnar or flattened depends upon the amount of colloid material within the lumen. It is noteworthy, in parts of the glands that show distinct histological changes of a hyperplastic nature, to find a marked diminution of the amount of colloid; very often there is an apparent absence of this material. Though the epithelium shows no appreciable microscopical alteration in cell morphology, there is undoubtedly a decided change in cell function as evidenced by the lack of colloid production. The absence of acinal contents naturally permits of a columnar type of cell lining.

Only rarely in thyroid hyperplasia were we able to detect more than two layers of epithelial cells lining the acini. Not even in the extreme grade of exophthalmic goitre were the cells heaped up. Often what appeared as several layers of " focal budding " could be explained by the fact that the knife had sectioned the gland alveoli at various places.

Infolding of the epithelium may occur in any thyroid gland when active hypertrophy is going on, especially in the absence of colloid production, no matter what the cause. The same fundamental principle governing the phenomena is also met with in other glandular organs which are the seat of hypertrophy; for example, the prostate, where the infolding is sometimes beautifully illustrated.

In some instances three or more of the above described types of lesions occur in the same gland, while in others the histological change is confined to one type. It is especially notewothy in the gland of exophthalmic disease to find multiple lesions, widely separated and distinctive in character, though the lesion may be single and confined to one area and without histological variation.

The following cases are detailed in illustration of our findings:

CASES OF TRUE GRAVES'S DISEASE WITHOUT ANY INFOLDING AND BUDDING OF THE EPITHELIUM, WITH OR WITHOUT MUCH INCREASE IN CONNECTIVE TISSUE.

CASE I.—Miss G., aged 29. Has had a slightly enlarged neck for some years; on examination only a small nodule can be felt above the sternum. Is excessively nervous, has tachycardia (pulse 100–120), tremors, marked exophthalmos. Operation: removed two large lobes situated beneath the sternum. Microscopic examination shows no infolding or budding of the epithelium, but there was a cystic condition and acini filled with colloid, some increase of connective tissue which contains collections of lymphoid and plasma cells; and some interstitial hemorrhage.

CASE II.—Miss B., aged 38. Had been treated in the medical wards of the Montreal General Hospital for six months for a very severe form of Graves's disease. Tachycardia (130–140), tremors, exophthalmos, dilated right heart, extreme emaciation, etc. Removed most of a not very large thyroid and ligated all the vessels; and yet the microscopic examination showed no infolding and budding of epithelium, but much colloid and slight increase of connective tissue.

CASE III.—Miss C., aged 24. Some years ago noticed a small lump in the thyroid. At the same time got excessively nervous, pulse ranged from 130–140, with marked palpitation. When I saw her she had an enlarged thyroid, tremors, slight exophthalmos, Stellwag's sign, pulse 130, breathlessness, unable to go upstairs. Removed the right lobe and isthmus and tied all the thyroids. After operation marked thyroidism for twenty-four hours. On microscopic examination no infolding or budding of epithelium found, but much colloid and some increase of connective tissue.

CASE IV.—Henry H., aged 53. Great nervousness, tachycardia, tremors, emaciation, Stellwag's sign, commencing enlargement of right heart. On microscopical examination found no infolding of epithelium but very small acini, intra-acinal hemorrhage, and the gland markedly cystic in many places.

CASE V.—Miss P. B., aged 25. For two years had been excessively nervous, but no enlargement of the thyroid gland. Then enlargement was noticed and at the same time her eyes became prominent. Became unfit for her work of teaching and consulted Dr. Shepherd. At this time it was noted that she had considerable enlargement of both lobes of the thyroid, which were soft and vascular. Eyes very prominent and both Stellwag's and Graefe's signs present. Excessive nervousness, tremors, loss of flesh, with tachycardia (130–140), breathlessness. She also had temperature and some swelling of legs. The right heart was moderately distended. The case was one of well-marked Graves's disease, and she was admitted to the Hospital and treated medically for some weeks. At her earnest request an operation was performed and the right lobe of the thyroid and the isthmus removed; the left superior thyroid was tied. She did well for twelve hours, when her pulse became uncountable; she was excessively nervous, tossing about the bed, and soon became delirious and died twenty-four hours after operation. Her temperature never rose above 99.5°. The microscopic examination showed no infolding or budding of epithelium, but the acini were much increased and distended with colloid and the epithelium lining them was flattened.

CASES WITH MARKED INFOLDING AND BUDDING OF EPITHELIUM OF THE GLAND AND YET NO GRAVES'S DISEASE.

CASE I.—Mrs. B., aged 33. For many years had an enlargement of the neck on right side; at times larger than at others. Some two months before seeing her it had grown very rapidly. On examination was found a round, smooth tumor of the right lobe of the thyroid the size of a Tangerine orange; did not extend below the bony thorax, and appeared to be a large tense cyst. No tachycardia, no tremors, no exophthalmos, and no difficulty in breathing or swallowing; evidently a very nervous woman. Removed right lobe of thyroid which contained one large cyst and several small ones.

CASE II.—Miss H., aged 25. Has had a swelling of neck since she was 16 years old; tumor in mid-line. Has never grown rapidly. Has some breathlessness on exertion and attacks of dyspnœa, no tremors, no exophthalmos; pulse 90; considerable dysphagia at times when solids are taken. Operation: removed an adenoma by enucleation. All symptoms relieved. In addition to infolding there was chronic inflammation and increase in connective tissue.

Case III.—Mrs. D., aged 54. Two years ago noticed a small lump on the left lobe of the thyroid; has grown rapidly. On examination found one large and one small tumor in left lobe, largest, size of a large orange and other of a walnut, evidently cystic. No tachycardia, no tremors, no exophthalmos, no evidence of Graves's disease; pulse 80. Operation: removed left lobe and isthmus. In this case there was, in addition to the infolding and budding of epithelium, chronic inflammation with a lot of lymphoid and plasma cells and considerable colloid; no increase in connective tissue.

Case IV.—Mrs. E., aged 39. For ten years had general enlargement of the thyroid, commenced when carrying first child. No tremors, no nervousness or ocular symptoms. Difficulty in swallowing; pulse 84. Hypertrophy and dilatation of epithelium; infolding and budding and much hyperplasia.

Case V.—Miss F., aged 28. Has had "swelling of throat" for eight or nine years, which of late has caused some difficulty in breathing. Has taken thyroid extract with benefit. Of late the goitre has been increasing rapidly. On examination found an evenly enlarged thyroid, soft and vascular; pulse 98. No exophthalmos, no tremors, but only complains of breathlessness on exertion. Examination by larynx revealed pressure on the right side of the trachea opposite the fourth to the seventh rings of the trachea. Right lobe and isthmus removed. Much relieved by operation and was practically well six months later. Microscopic examination showed infolding of acinal epithelium in places and much hyperplasia; in others acini dilated with colloid and flattened epithelium.

Case VI.—Miss A. H., aged 26. Six years ago noticed a small lump on the right side of the neck; grew very little until a few months before admission to Hospital under Dr. Bazin. Lately has been troubled with difficulty in swallowing and shortness of breath on exertion. Growth on right side and size of a goose egg. Pulse 78. No tremors, no exophthalmos or nervousness, absolutely no signs of Graves's disease. The growth was removed and on microscopical examination showed well-marked infolding and budding of acinal epithelium, with large areas of increased connective tissue and diminution of colloid. In some parts there was acinal dilatation.

CASE VII.—Mrs. O., aged 40. Has had for some years a cyst of the thyroid which has been constantly increasing in size and from the discomfort and difficulty of breathing caused she desired operation. There were no nervous symptoms, no tachycardia, no tremors, in fact no symptoms indicative of Graves's disease. Dr. Elder removed the cyst by enucleation and she recovered rapidly. The microscopic appearance showed well-marked infolding and budding of the epithelium of the acini.

CASE VIII.—*Graves's disease with typical infolding, etc., in the right half of gland, which was first removed. Later great increase of left lobe with return of symptoms. This on removal showed no infolding of epithelium but merely acini distended with colloid and lined with flattened epithelium.*

Miss R. R., aged 23. For four years had suffered from symptoms of Graves's disease which came on with enlargement of the thyroid. Had tachycardia, tremors, nervousness, vomiting, high temperature, great exophthalmos, and enlargement of the right heart. Was in New York at the time and had the thyroids tied in one of the large hospitals, but secured no benefit from this treatment. In October, 1908, the right half of the thyroid was removed at the Montreal General Hospital with great benefit. The pulse was reduced to below 100, nervousness was less, and she was in every way better and able to return to her work. In the beginning of 1909, the left side of the gland began to enlarge rapidly and all the old symptoms returned. On admission to the Hospital in April, 1909, she seemed to be as bad as before the operation in 1908; in addition she had dilatation of the right pupil. The left half of the gland was removed, only a small piece being left on the trachea. She rapidly recovered from the operation and a month later all the symptoms had been much alleviated. The exophthalmos had disappeared from the right eye and the pupil was normal in size. The exophthalmos of the left eye, however, was as marked as ever. The microscopic appearance of the portion of gland first removed showed well-marked infolding and budding of the epithelium in the acini. The gland removed at the second operation showed no infolding of budding of the epithelium but merely acini lined with flattened epithelium and full of colloid.

EXCISION OF THE LARYNX FOR CARCINOMA.*

BY JAMES BELL, M.D.,

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JUDGING from the contributions on this subject which one finds in surgical literature in the English language, it appears to me that the operative treatment of malignant disease of the larynx has received much less attention from English and American surgeons than it has deserved.

My own experience in this field has been limited to twelve complete laryngectomies and three thyrotomies with intralaryngeal operation; and while the results have been far from brilliant they have been to me very instructive and very encouraging. In this communication I shall speak only of the twelve complete laryngectomies, as the partial operations were not satisfactory, and, in fact, were not well chosen.

My limited experience has shown me that the technical difficulties of the operation and the danger from interference with respiration during operation are much less than one would "*a priori*" expect, and also that the great postoperative danger, justly so much dreaded in extensive operations involving the pharynx, aspiration pneumonia, may be entirely or almost entirely avoided by attention to the posture of the patient during and after operation. This latter point has been strongly insisted upon by Gluck, whose results have been almost phenomenal. Compared, for example, with extensive operations upon the tongue for cancer, I believe that extirpation of the larynx is a much simpler and safer operation, with much less postoperative danger and much less danger of recurrence, as well as an operation which gives a much better functional result.

In intrinsic laryngeal cancer the cartilaginous framework of the larynx resists for a long time the invasion of the lymphatic system, so that even in far-advanced disease there may be no extension beyond the boundaries of the larynx itself. Theoretically, the tributary lymphatics should be removed in every case; and in any case where there is evidence or suspicion of their involvement their removal is imperative. At the same time, intralaryngeal cancer produces symptoms from the very outset and on examination by a competent laryngologist, the new growth can usually be discovered and a portion of it removed for microscopical examination at a quite early stage of the disease. If by the aid of the microscope the diagnosis cannot be confirmed, operation should be undertaken with a view to an exploratory thyrotomy as a first step. The functional result after complete laryngectomy is usually very satisfactory, and the inconvenience slight, although the patient may, in some cases, have to wear a tracheal tube part of the time or even perhaps constantly.

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* Read before the American Surgical Association, June 3, 1909.

Attempts to use an artificial larynx have been generally abandoned for many years, so that convalescence is expedited, swallowing is not interfered with and the operation itself is much simplified by the immediate closure of the pharynx.

It has been found that even without any form of phonation apparatus, satisfactory whispering speech can be developed. This was studied some years ago by Dr. J. Solis-Cohen (*Journal of the American Medical Association,* vol. xvi, p. 834) in a patient of his in whom speech was developed to a remarkable degree; and although no attempt was made in any of my cases to provide for an artificial larynx or to use any form of phonation apparatus, a very fair amount of whispering speech was developed after a little time, in all cases, so that the patient had very little inconvenience in communicating with his family and friends. In fact, the result, as far as speech was concerned, was not much inferior to that which I have observed in cases after the intralaryngeal removal of a new growth.

Since February, 1898, I have removed the larynx in 12 cases for carcinoma. Seven of these operations were for intrinsic laryngeal cancer, all far advanced; and in one of these, the disease had extended to the pharynx. In 5, the primary disease was in the pharynx and had invaded the larynx secondarily. Of the 12 cases operated upon, 7 recovered; one of the 7, however, died on the fifty-eighth day from recurrence, or rather from extension, along the carotid glands into the mediastinum. Of the 5 deaths, 2 were from pneumonia—seven and fifteen days after operation respectively—and 2 from cardiac causes—four and five days respectively after operation. In one unfortunate case in which the patient was suffering from complete obstruction in the œsophagus, I was unable to get below the disease, and all that I could do was to fix a tube into the œsophagus after operation. Death occurred within three days. This woman had come from the Pacific coast for operation. She had not been able to swallow solids for a month, and at the time of operation she had not been able to swallow anything for seven days. I recommended gastrostomy, but she insisted upon radical operation, and I yielded, contrary to my judgment. It was impossible even at the operation to determine the lower limit of the disease in the œsophagus.

Of the 7 cases of intrinsic laryngeal cancer, 4 recovered and 3 died; and of the 5 cases in which the disease was primary in the pharynx, 3 recovered and 2 died.

In the first 4 cases, I did a preliminary tracheotomy and removed the larynx from above downwards. One of these cases died of pneumonia. In the last 8 cases, no preliminary tracheotomy was done, and the mass was removed from below upwards after fixation of the tracheal stump to the skin. This is undoubtedly a much better method of extirpating the larynx than by operating after preliminary tracheotomy. In all cases, operation was done with the patient in an exaggerated Trendelenburg position, and the patients kept in this position with the foot of the bed elevated for some days after operation. The intention was to allow of the secretions gravitating upwards rather than gravitating downwards into the trachea and invading the lungs. I am of the opinion that this attention to posture is most important. In all cases the pharynx was closed and no attempt was made to prepare the patient for an artificial larynx.

Chloroform was the anæsthetic employed and no difficulty was experienced with the breathing even during the manipulations which were necessary to free the larynx from the neighboring tissues. The operative procedure was briefly as follows. With the patient in the Trendelenburg position and the neck extended, a median incision was made from the hyoid bone to a point a little below the cricoid cartilage. From the upper extremity of this incision on each side, a transverse incision was made to—or nearly to—the border of the sterno-mastoid muscle. The larynx was then separated from the surrounding structures. In cases of purely intralaryngeal growth, the box of the larynx was separated from its attached muscles by blunt dissection. In the cases in which infected glands or other structures were to be removed, the line of cleavage was made by dissection at a more remote point. In any case, after the mass to be removed—the larynx and whatever structures were to be removed with it—had been entirely isolated, the isthmus of the thyroid was divided between ligatures and the trachea freed for some distance below the cricoid. (The most difficult dissection of all is the separation of the cricoid cartilage and upper rings of the trachea from the upper part of the œsophagus.) Two strong silk sutures were then inserted into the trachea, usually between the second and third rings, and brought out so as to include the ring above. The trachea was then severed between the cricoid and the first ring or between the first and second rings, and the stump withdrawn through a transverse incision made through the skin and fascia a little below the lower end of the vertical incision; and sutured to the skin with silkworm gut sutures.

It is important, I believe, to bring the stump of the trachea well forward, so that at least one ring shall project beyond the skin. Subsequent retraction of the tissues will bring this down to the level of the neck.

It is also, I think, important to bring it out through a transverse incision to prevent the cartilaginous rings from closing in upon the posterior membranous portion of the trachea, thus narrowing its lumen.

The larynx was then dissected from below upwards and removed. In all my cases the epiglottis was included in the mass removed. The pharynx was then, where possible, completely closed with the exception of a small opening on one or both sides at the outer extremity of the transverse incision, into which a drainage tube was inserted to allow of the draining away of the mouth and pharyngeal secretions and to prevent their accumulation in the pharynx. It was hoped in this way to avoid efforts at swallowing.

In some of the cases, which I shall mention specially, portions of the œsophagus and considerable areas of the pharyngeal structures were removed and complete restoration of the pharyngo-œsophageal canal was impossible.

In the cases in which the pharynx was completely closed, the question of feeding the patient had next to be considered. In my earlier cases, I introduced an œsophageal tube from the outer extremity of the transverse incision on one side and fed in this way for a time. In other cases, I introduced a tube through the nostril into the œsophagus; and in still others, I passed a tube into the œsophagus through the mouth, attaching a silk thread to it and allowing it to lie within the buccal cavity.

All these methods of feeding are more or less objectionable and, in my opinion, this is the most difficult question to deal with in connection with the operation.

In one case—Case III—I made no such provision for feeding—fed by rectum for twenty-four hours; then introduced a stomach tube twice during the next day; and on the third day allowed the patient to swallow; which he was quite capable of doing. The result was infection of the wound, considerable sloughing of tissue and a very much prolonged convalescence. This, I believe, to be a real source of danger in allowing the patient to swallow too early. I now feel disposed to go back to the method of inserting a large sized catheter into the œsophagus from the extremity of the transverse portion of the incision in the neck.

In all cases which survived, a satisfactory amount of whispering speech was developed.

Case I lived for either four or five years and died from recurrence in the lungs, as shown by autopsy. From his own account, he developed speech to a very satisfactory degree.

Case II lived four and a half years and died of an acute abdominal condition of seven days standing; either peritonitis or intestinal obstruction. He acquired a useful amount of speech.

Case III lived seven years and eight or nine months and died of recurrence at the base of the skull. He developed an amount of speech which enabled him to carry on an extensive business quite satisfactorily.

Case IX, who was operated upon in March, 1908, and last seen in January, 1909, was then in perfect health, but had not, up to that date, developed speech to any very great extent.

Cases X and XI are recent operations and did not develop a great degree of speech. Case XI died of pharyngeal recurrence six months after operation.

It is sometimes necessary before proceeding to complete laryngectomy to do a thyrotomy in order to demonstrate the condition within the larynx.

In all the cases which I have had to deal with, the diagnosis was unmistakable both as regards the nature of the disease and its extent; at all events it was quite clear that it was sufficiently extensive to justify a complete laryngectomy, and I cannot help thinking that complete laryngectomy is a safer operation, in most cases, and gives practically as good a result as hemilaryngectomy or intralaryngeal removal after thyrotomy, except when the disease is very limited and seen very early, and also that an exploratory thyrotomy should in most cases be unnecessary and must to some extent complicate the operation.

After-treatment, in addition to the question of feeding, is important. Some surgeons recommend that the patient should be allowed to sit up within a day or two after operation. The reasons given for this advice are, of course, convincing, but at the same time I believe that the necessity of guarding against the entrance of wound secretions into the trachea is more important than any other single consideration. Moist gauze placed over the tracheal orifice and a warm room with equable temperature and moist air and change of position from side to side, are the most important indications.

In two of my cases (V and XII) where death occurred with cardiac symptoms, I am of the opinion that perhaps more systematic attention to feeding and stimulation might have tided them over.

The high mortality rate in this series was due, at least to some extent, I believe, to the fact that operation was decided upon in every case entirely from the local conditions, and in several of the cases the general condition of the patient while not so bad as to preclude operation was far from satisfactory. It will be noted that in every one of the fatal cases, there was some serious complicating condition.

Case V was a feeble old man of 74 years, with very advanced disease.

Case XII, æt. 56, was a patient who had deferred operation until breathing had become almost impossible. Autopsy showed fatty infiltration and degeneration of the heart and acute myocarditis.

Of the two cases which died of pneumonia, Case IV was a man aged 60 who had been compelled to depend entirely upon the catheter to evacuate his bladder for five years prior to operation, on account of prostatic disease.

Case VIII, a woman aged 50, had a large cancerous growth in the pharynx and upper portion of the œsophagus which had extended to the larynx. She had suffered great pain and difficulty in both swallowing and breathing for some time before operation and was in an exhausted condition.

Case VII has already been referred to as having presented herself with an extensive cancer of the œsophagus which had prevented her from swallowing even liquids for seven days prior to operation. She was in an almost moribund condition and should not have been operated upon at all.

Cases X and XI present some points of special interest. In Case X I removed a considerable area of the pharynx with the retropharyngeal tissues and lymphatic glands. I then attempted to unite the upper and lower pharyngeal borders at some points, with the hope of securing some continuity of mucous membrane which would protect against contraction and might even perhaps cause some epithelial growth to extend over upon the cicatricial tissue. The tension was too great and the result was a failure. Contraction of this portion of the pharynx occurred, for which the patient is obliged to wear a tube to keep the passage open sufficiently to enable her to take food. She takes out the tube at meal times and swallows naturally, but wears it in the intervals. This is, of course, a serious inconvenience.

In Case XI I was barely able to bring the stump of the œsophagus out and attach it to the skin below and to the side of the tracheal stump. The removal of pharyngeal tissue was so extensive that there was no possibility of establishing a communication with a continuity of mucous membrane between the mouth and the œsophagus. This patient fed herself with a tube and got along very well, but has since died from local recurrence.

In conclusion, I desire to express my opinion that complete laryngectomy is an operation which should have almost no essential mortality,—and when diagnosis is made early, which can be so readily done, there should be no recurrence of the disease. Moreover, the patient's comfort should be greater than after most operations which involve the ablation of an important organ.

I have not had the experience to justify me in comparing total laryngectomy with hemilaryngectomy or thyrotomy for the removal of intralaryngeal cancer, which latter operation has been so highly recommended by English authorities—notably, Mr. Butlin and Sir Felix Semon—but, as a general surgeon, the principle of wide extirpation of the local disease appeals to me very strongly, and the condition of the patient after operation is a much more tolerable one than it is generally thought to be.

THE OPERATIVE TREATMENT OF HEART WOUNDS.

REPORT OF A CASE OF WOUND OF THE RIGHT AURICLE; SUTURE; RECOVERY. TABULATION OF 158 CASES OF SUTURED HEART WOUNDS.

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On the evening of June 14, 1908, at about eleven o'clock, a colored girl, 24 years of age, was brought to the Roosevelt Hospital in the ambulance, having been stabbed in the chest with a pocket-knife about 20 to 30 minutes before her arrival at the hospital. I happened to reach the hospital at almost the same moment on a call to another case, and saw the patient in less than five minutes after her admission. The ambulance surgeon and house surgeon had already concurred in a diagnosis of wound of the heart. There was no radial pulse, but a weak pulse varying in force and volume with each inspiration and expiration could be felt high in the brachial artery, and in the carotids. The heart sounds could not be heard. Respiration was faint and shallow, extremities cool, and the patient in profound shock. The area of cardiac dulness was increased but no attempt was made to accurately map it out. The left pulmonary signs were normal. The patient was intoxicated, restless and irritable when aroused, otherwise apathetic. There was a stab wound at the left border of the sternum over the third costal cartilage, which bled very little, and two superficial stab wounds on the right and left breasts respectively, as well as several scars on face, chest and arms, the result of previous battles (see Fig. 1).

The patient was taken at once to the operating room and chloroform and ether anæsthesia commenced, at 11.15 P.M., about 45 minutes after the receipt of the injury. A quadrangular flap with base external, its margins at the second interspace, left half of sternum, and fifth interspace, was rapidly marked out and the soft parts dissected back. A portion of the sixth costal carti-

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* Read before the American Surgical Association, June 4, 1909.

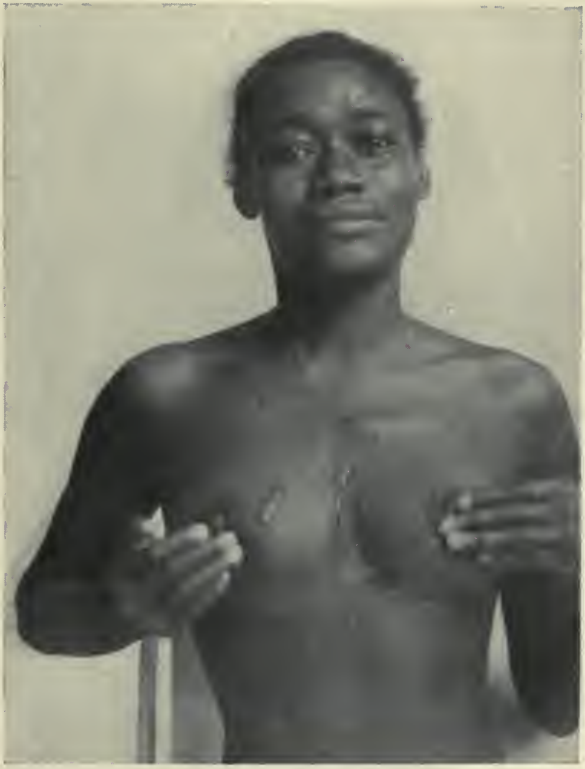
lage was excised, the fourth and fifth cut at their sternal attachments, and the third found to have been severed by the stab wound. The internal mammary vessels were ligated above and below, the third, fourth and fifth ribs partly cut through with bone forceps near the costochondral junction to form a hinge and the musculocartilaginous flap carefully lifted, the pleura being pushed away from its deep surface with gauze pads. Except for an accidental tear near the lower portion of the flap, which was covered at once with gauze pads, no opening in the pleura was made. The stab wound in the pericardium, about 1.5 cm. long was so close to the edge of the sternum, that for a good exposure, removal of a portion of the bone with rongeur forceps was necessary. The pericardial wound was apparently closed by clot or the valve-like effect of the intrapericardial tension, and did not bleed, but there was a considerable amount of clot infiltrating the areolar tissue of the anterior mediastinum. Intrapericardial tension was so great that the heart beat could not be felt even with the finger directly on the sac. The pericardium was opened with a 3-inch longitudinal incision, 1 inch to the left of the stab wound, and about 300 c.c. of dark blood escaped with a gush, the anæsthetist noting immediate return of the radial pulse. The degree of "heart tamponade" had been extreme, and had evidently nearly reached the fatal limit of complete arrest of venous return to the auricles.

The bleeding seemed to come from the upper right portion of the pericardial sac, but the rapidly beating heart, churning the free blood, made it impossible to locate the wound until a transverse cut in the pericardium to the right gave a better exposure. Then by lifting the heart forward with the left hand and rotating it slightly to the left, a wound of the right auricle about 1 cm. long and 2 cm. above the auriculoventricular groove, was brought into view. With each systole a stream of dark blood spouted two or three inches. A suture of No. 0 chromicized catgut was passed on a curved intestinal needle and tied, the ends left long, helped to steady the heart while three more similar sutures were inserted—four in all—completely controlling the bleeding. An effort was made to avoid piercing the endocardium, but whether successful or not, in the thin auricular wall, is doubtful. The rapid, tumbling action of the heart made it impossible for me to tell whether the sutures were passed and tied in systole or diastole. The pericardium was emptied of blood and clot with the hand and gauze sponges, and closed without drainage with continuous sutures of No. 2 chromicized catgut. The musculocartilaginous flap was carefully sutured with No. 3 chromicized catgut, the flap of soft parts, after excising the stab wound, with catgut, silkworm-gut and a continuous silk suture. The suture of the flaps completely closed the accidental tear in the pleura and stopped the sucking in of air. No drainage was used. An intravenous saline infusion of 1200 c.c. was given on the table during the progress of the operation, which lasted 65 minutes. On return to the ward from the operating room, her pulse was 136; respiration, 56; temperature, 99.6. Six hours later another infusion of 900 c.c. was given, as the pulse had become very weak.

For the first six or seven days there were signs of a mild pleurisy (dulness and diminished voice and breathing) in the left chest; temperature ranged from 100 to 102.8; pulse, 116 to 136; respiration, 24 to 36. At the end of the second week the signs had nearly disappeared, and pulse and temperature were approaching the normal. The wound healed by first intention; all sutures were removed on the eighth day; she was allowed out of bed on the seventeenth day and left the hospital well on July 8, 24 days after the operation. Her pulse at that time was 80–96, regular and of good quality. The heart sounds were normal and the signs of pleurisy had disappeared.

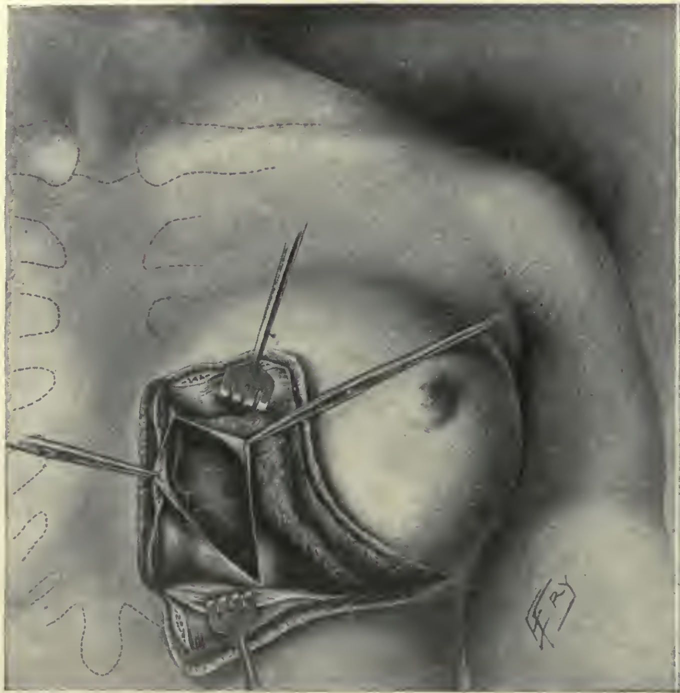
Nearly all writers on heart wounds of both clinical and experimental work, have considered wounds of the auricles more dangerous than those of the ventricles, but of the 11 reported cases of auricle wounds operated upon, 7 have recovered and 4 have died—a mortality of 36.3 per cent., while the general mortality of sutured heart wounds is about 64 per cent. Of the 160 tabulated cases there were 69 of the right ventricle with 48 deaths (69.6 per cent.); 74 of the left ventricle with 45 deaths (60.8 per cent.); 5 of the left auricle with 2 deaths (40 per cent.); 6 of the right auricle with 2 deaths (33.3 per cent.); and 7 miscellaneous cases with 5 deaths (71.5 per cent.); a total of 102 deaths and 58 recoveries (63.7 per cent.).

FIG. 1.



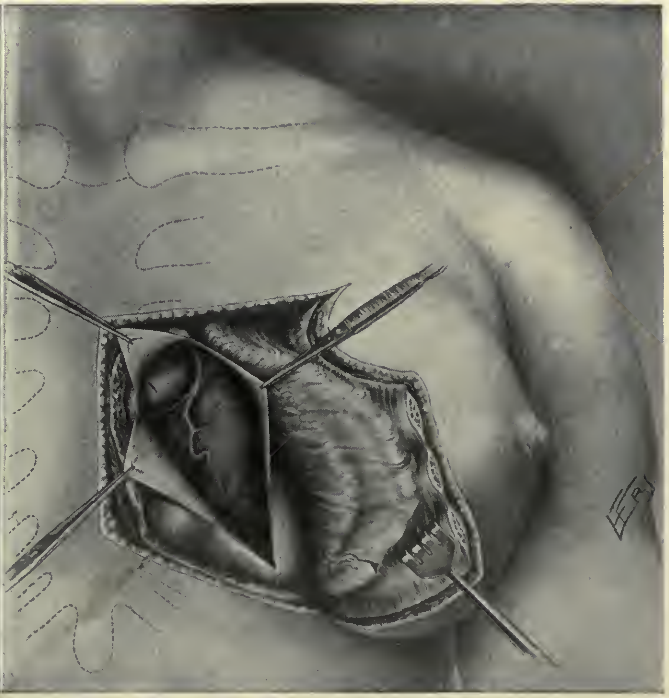
Photograph taken three weeks after operation, showing healed incision and scars of other stab wounds. (Author's case.)

FIG. 3.



Long intercostal incision in fifth space, with division of fourth, fifth, and sixth cartilages at their sternal attachments, forming two triangular flaps. Pleura freely opened.

FIG. 2.



Quadrangular flap of third, fourth, and fifth ribs, hinge external. The drawing represents in addition the removal of part of the sternum, additional transverse incision in pericardium, accidental tear in pleura, and wound of auricle—author's case. With care in elevating the flap, the pleura may be pushed back without injury.

Except as regard the auricle wounds these statistics do not vary greatly from those that have been published from time to time during the past nine or ten years, by Giordano, Hill, Rehn, Lenormant, Stewart, Vaughan, and others. In only a comparatively small precentage of all inflicted heart wounds will surgical intervention be possible. In the larger wounds fatal hemorrhage into the pleural cavity or through the external wound usually takes place. In smaller wounds the pericardial opening may be closed by clot or valve-like pressure, producing the so-called "heart tamponade," the intrapericardial pressure preventing the entrance of blood through the great veins in to the auricles, and consequent pumping dry of the ventricles. In this condition it is the mechanical choking or drowning of the heart, and not the loss of blood which determines the fatal issue. Spangaro's [96] conclusions from recent experimental work are that "the consequence of hæmopericardium is to render diastole difficult and aspiration insufficient, whence an important and progressive lessening of blood pressure and weakening of the pulse. For this the hæmopericardium need not be abundant. After removal of blood from the pericardium the pressure augments and the pulse becomes more or less normal."

This has been strikingly shown in many of the cases operated upon, my own included, and has led to the suggestion that preliminary aspiration of the pericardium be made as soon as the case is seen, to give temporary relief while preparation for the operation is being made. Few if any deaths are directly due to the shock of the heart injury. Kronecker and Schmey [51a] claim that there is a point at the junction of the upper and middle thirds of the interventricular groove, where in animals simple puncture is capable of causing immediate and permanent stoppage of the heart's action, and have called this the "co-ordination centre."

Elsberg,[23] in an elaborate series of experiments on animals made in 1899 at Breslau, showed conclusively that the heart in dogs and rabbits is capable of resisting trauma to an astonishing extent, even ligation of the entire heart at the junction of the lower and middle thirds of the ventricles and amputation through the ventricles below the ligature being followed by recovery of the animal.

Traver's [105] case corroborates the view that the human heart has similar powers of resistance. A boy 19 years of age was impaled on an iron picket fence. The sternum was fractured and the right ventricle wounded, the heart wound being plugged by a fragment of bone. Terrific bleeding through the extensive tear in the heart wall followed removal of the fragment of bone, the hemorrhage being temporarily checked by three fingers passed through the wound into the cavity of the ventricle. Twenty-three stitches (in two tiers) were used in closing the 2¼-inch wound in the ventricular wall, and the patient lived more than ten days, death occurring from slow secondary hemorrhage into the pericardium due to imperfect healing of the contused and lacerated wound edges, and not from sepsis. This was probably the most extensive heart wound ever sutured with even temporary success.

Certain and rapid healing of sutured heart wounds may be definitely counted upon if death from hemorrhage or shock is averted, and septic infection prevented. Elsberg has shown that repair takes place as in other muscles, by the formation of fibrous cicatricial tissue and not by regeneration of heart muscle, but that it is none the less strong, and the function of the heart muscle is not seriously impaired.

The suggestion that wounds of the human heart might be sutured was made by Dr. Roberts of this Association in 1881 and was received with skepticism. Farina [24] of Rome, in 1896, is credited with the first operation, and Rehn [82] of Frankfort in 1897 with the first recovery. In this country Nietert [70] and Vaughan [108] led the way in 1901, and up to the present time 16 cases have been operated upon with 7 recoveries. The 160 tabulated cases have been reported by 121 different operators, no surgeon having reported more than three cases. The rarity of the opportunity and the importance of prompt and definite action make it desirable that every surgeon to whom such a case may come should be familiar with the best plans of operative procedure, in order that the choice of method may be instantaneous and the steps executed without delay. These steps involve the consideration of:

1. Anæsthesia.
2. Local preparation of the operative field.
3. Choice of method of exposure.
4. Temporary control of hemorrhage while sutures are being placed, and sutures.
5. Stimulation and resuscitation.

Anæsthesia.—Of this little will be said; the need of a general anæsthetic and the method of administration is decided by the operator on general principles, as in other desperate conditions.

Local Preparation of the Operative Field.—As infections have occurred in more than 50 per cent. of all patients who have recovered, and at least 40 to 50 per cent. of the fatal cases, this is a matter of vital importance. It should be done rapidly but thoroughly, while the patient is being anæsthetized, the usual cleansing with soap and water, alcohol, etc., being followed by the application of tincture iodine or Harrington's solution to the entire operative field. The operator should be ready by the time the patient is prepared and anæsthetized, and the whole proceeding should take very few minutes. Excision of the original stab or bullet wound in the soft parts is also important, as some of the infections have undoubtedly originated here.

Choice of Method of Exposure.—The fact that the 158 reported cases have been distributed among 119 different operators helps to explain the diversity of opinion as to the best method of approach, and the many methods which have been employed.

The quadrangular flap with hinge external, including from two to five cartilages has much to commend it (Fig. 2). It has been the favorite method of the French since Fontan's case in 1900. It gives a good exposure, can be rapidly formed with few vessels to control and makes it possible to avoid injury to the pleura, an important point if hæmopneumothorax is not already present.

A quadrangular flap with hinge internal at the sternal border has been used many times, but gives a less free exposure of the right ventricle and auricle and widely opens the pleura. In a few cases this latter type of flap has included transverse divisions of the sternum at its base, the hinge being made at the junction of the right costal cartilages with the sternum. This procedure endangers the right pleura, injury to which would mean double pneumothorax and death (see Case 127).

A long intercostal incision, usually in the fifth or fourth spaces, to which may be added division of one or more cartilages at their sternal attachments, forming one or two triangular flaps (Fig. 3), is another method advocated of late on account of its simplicity and rapidity of execution. It involves free opening of the pleura, but in many of the cases the pleura has already been wounded and hæmopneumothorax is present. In some cases—tall individuals with wide intercostal spaces—the intercostal incision with strong retraction gives sufficient exposure without cutting rib or cartilage.

The dangers of pleural opening will be greatly diminished if the principle of performing thoracic operations under negative or positive pressure, which is now attracting so much attention in the surgical world, becomes practical and more generally available.

Temporary Control of Hemorrhage While Sutures are Being Placed; Sutures.—After the pericardium is freely opened by enlarging the original wound or by a longitudinal incision, fresh bleeding increased by the relief of intrapericardial tension, may be a serious danger. The heart wound may be large enough to be plugged temporarily by a finger, or rarely more than one, as in Travers' case. Haecker [42a] has recently shown on dogs that compression of the base of the heart between two fingers, completely shutting off return of blood to the auricles, is borne without ill effect about 1½ minutes continuously, and up to 10 minutes with short intermissions. Generally, it has been sufficient to quickly place one or two sutures to co-apt the edges of the wound enough to partly check the hemorrhage, adding others to complete the control if necessary, more deliberately.

The end of the first suture left long is a great aid in steadying the heart for the placing of others. A separate temporary stitch through the muscle at the apex for this purpose, as advocated by Spangaro, should be unnecessary. Sutures of fine catgut, chromicized catgut, or silk have proven equally efficacious and harmless. A small curved intestinal needle should be used, and the endocardium should not be included in the stitch. Interrupted, continuous or mattress sutures may be used. A slight irregularity of the heart's action may be caused by the first manipulation with the hand or needle puncture, but it is the experience of most observers that this effect it quite transitory and the heart soon recovers its equilibrium.

Stimulation and Resuscitation.—The most effective stimulation is intravenous saline infusion given while the operation is in progress, which has been successfully used in many of the reported cases. Direct heart massage, for cessation of the heart beat, has been employed several times, with apparently benefit in some instances. It should be given a thorough trial before abandoning a case as hopeless, combined, perhaps, with direct infusion into the ventricles.

Wound Closure and Drainage.—A study of the Table shows, excluding 35 cases which died on the table or very soon of hemorrhage or shock, and 13 of unknown causes, that in the remaining 112 it is definitely stated that 67 (60 per cent.) had infections of pericardium or pleura or both, 41 of whom died and 26 recovered. Unquestionably the use of drainage has in some instances favored the development of secondary infections of pleura or pericardium, and I believe that closure of both without drainage, in conjunction with systematic careful preparation on the lines suggested, is, as a rule, the best procedure. If the pleura has contained much blood and has been widely opened, drainage of the pleura alone may be indicated and should preferably be made pos-

TABLE I—WOUNDS OF THE

No.	Operator. Year	Location and character of external wound. Sex. Age	Complicating injuries	Time between wounding and operation	Position and size of heart wound
1	BARTH 1901	Stab wound through ensiform cartilage	Right pleura and tricuspid valve wounded	½ hour	Right vent. 2 cm .
2	BARTH 1902	Stab wound 3 cm. within and below left nipple	....	1 hour	Right vent. 0.75 cm.
3	BAUDET 1906	Stab wound in 5th left space, 2.5 cm. within and 1 cm. below left nipple. Male; 23 yrs.	....	1 hour	Right vent., near interventricular groove, very small
4	BAYHA 1908	Stab wound below 5th rib, 2 fingers' breadth from sternum. Male; 24 yrs.	Left pleura filled with blood	2–3 hours	Right vent., middle, transverse. 1 cm.
5	BLAKE 1907	Stab wound through 4th left cartilage, 1 cm. within nipple line. Male; colored	Left pleura contained 2 pints of blood; pericardium about 2 oz.	2½ hours	Right vent. 1 cm.
6	BORZYMOWSKI 1903	Two stab wounds over 4th left cartilage	....	....	Right vent
7	BOUGLE 1901	Pistol-shot wound in 3rd left space, one finger's breadth from sternum	....	½ hour	Right vent. 2 wounds
8	BRENNER 1900 (report by Zulehner)	Stab wound at border of sternum, level of 6th cartilage. Male; 35 yrs.	Penetrating abdominal wound	More than 24 hours	Right vent. 2 cm.
9	BUFNOIR 1899	Pistol-shot wound, 22 caliber, in 5th left space	....	....	Right vent.
10	CAMUS 1905	Stab wound in 4th left space, 1 finger's breadth from sternum, 2cm. in length. Male; 43 yrs.	Left hæmothorax, large amount	1 hour	Right vent. 1 cm.
11	CAMUS 1905	Stab wound in 3rd left space, midway between nipple and sternum. Male; 18 yrs.	Left hæmothorax, large amount. Wound extended into root of pulmonary artery	1 hour	Right vent. 1.5 cm.
12	CAPELLO Cimorini 1904	Stab wound through 7th left cartilage, at margin of sternum	Peritoneum wounded	....	Right vent.
13	CARNABEL 1900	Stab wound in 3rd left space, 3 cm. from sternum	....	2 hours	Right vent. 2 cm.

RIGHT VENTRICLE

Operative procedure. Anæsthetic. Sutures	Drainage		Course and postoperative complications	Result and remarks
	Pericardium	Pleura		
Resection of 5th, 6th and 7th costal cartilages. Chloroform. 4 silk sutures	Drainage	Drainage	Pleuritis	Died on 4th day.
Resection of 5th rib and 6th cartilage. No anæsthetic. 3 sutures	No drainage	No drainage	Pleuritis	Recovered.
Quadrangular flap. hinge external. Pleura freely opened. Chloroform. Wound sutured	No drainage	No drainage	Pleuritis; not drained	Recovered. Patient ran 100 feet after receipt of injury.
Resection of 5th rib and 6th cartilage. Pleura freely opened. Ether and chloroform. 3 sutures, deeply placed	No drainage	Drainage in posterior axillary line; resect 9th rib	Empyema; secondary drainage 14 days after operation	Recovered. Examined 7 months later; heart sounds normal; action regular.
Flap of 3rd, 4th and 5th cartilages, hinge internal. Pleura freely opened. Ether. 3 interrupted silk sutures; 1 mattress suture over them	No drainage	No drainage. Gauze drain in stab wound	Double pneumonia; left empyema, drained on 26th day after operation. Wound infection	Recovered.
Flap of 3rd, 4th and 5th ribs, hinge external. Ether. One wound sutured	....	....	Pericarditis and pleuritis	Died two days later. Two wounds found; only one sutured.
Flap of 3rd, 4th and 5th ribs, hinge external. Chloroform. Both wounds sutured with catgut	No drainage	Drainage	....	Died 5 hours later. Ball had passed through wall of ventricle, not opening cavity.
Resection of 5th, 6th and 7th ribs. Chloroform. Sutures tore out at first. Suture not completed	....	....	....	Died on table. Heart muscle degenerated and friable.
Wound of entrance sutured; wound of exit not sutured	....	....	....	Died.
Flap of ½ width of sternum, 3rd, 4th and 5th ribs, hinge external. Pleura freely opened. Anæsthesia. Wound sutured with catgut	Small drain	Gauze drainage	Left pneumonia	Died 22 hours later.
Flap of 3rd, 4th and 5th ribs, hinge external. Pleura freely opened. Anæsthesia. Wound sutured with No. 0 catgut	....	....	....	Died on tabl
Resection of 4th, 5th, 6th and 7th cartilages. No anæsthetic. 8 sutures	Drainage	....	Suppurative pericarditis; heart sutures discharged in pus on 15th day. Subphrenic abscess	Died 2 months later.
Resection of 4th and 5th cartilages. Ether. 3 catgut sutures	Drainage	Drainage	Pericarditis and pleuritis	Died 4 days later.

TABLE I—WOUNDS OF THE

No.	Operator. Year	Location and character of external wound. Sex. Age	Complicating injuries	Time between wounding and operation	Position and size of heart wound
14	Chastenet de Gery....... 1908	Horizontal stab wound 5 cm. long in 3rd left space. 1½ cm. from sternum. Male; 24 yrs.	Left pleura full of blood; interventric; septum wounded	3 hours	Right vent. Near intervent. groove. 1 cm.
15	Dolcetti........ 1906	Stab wound in 5th left space within nipple line	....	1 hour	Right vent. 1.5 cm.
16	Farina.......... 1896	Stab wound at upper border of 6th left rib near sternum	....	....	Right vent. 6 mm.
17	Gaudemet....... 1905	Stab wound in 5th left space, 5 cm. from median line	Hæmopericardium, 200 c.c.	1¼ hours	Right vent, near auricle, 4 mm.
18	Gentil.......... 1904	....	....	....	Right vent.
19	Gerzen......... 1902	Stab wound below left costal arch	....	....	Right vent. 2.5 cm.
20	Gibbon.......... 1902	Stab wound through 4th costal cartilage. Male; colored; 25 yrs.	No wound of pleura	1 hour	Right vent. 1.5 cm.
21	Gibbon.......... 1905	Stab wound through 4th costal cartilage	Pleura not wounded	2 hours	Right vent. near auriculovent. groove, ¾ in.
22	Giudice......... 1905	Stab wound in 3rd left space	....	Soon	Right vent. 1 cm.
23	Grassman....... 1908	Stab wound in 4th space, 1 cm. from border of sternum. Male; 14 yrs.	Left hæmothorax, 1½ liters. Hæmopericardium, large amount	3¾ hours	Right vent. 1½ cm.
24	Grassman....... 1908	Stab wound in 4th space, 2 cm. from sternum. Male; 30 yrs.	Left hæmothorax, 1½ liters, very little hæmopericardium	½–1 hour	Right vent. transverse 3 cm.
25	Grekow and Zeidler..... 1903	Stab wound outside left nipple	....	5 hours	Right vent. near apex. 1.5 cm.
26	Grekow and Zeidler........ 1903	Stab wound in 2nd left space	....	4½ hours	Right vent. 1¼ cm.
27	Guenot......... 1905	Stab wound in 2nd right space, 2 cm. from sternum. Male; 32 yrs.	Right hæmopneumothorax; 1½ litres of blood	1 hour	Right vent. 1 cm.

RIGHT VENTRICLE—*Continued*

Operative procedure. Anæsthetic. Sutures	Drainage		Course and postoperative complications	Results and remarks.
	Pericardium	Pleura		
Flap of 3rd and 4th ribs, hinge external. No anæsthetic. Several catgut sutures	....	....	....	Died on table; heart massage continued for 35 to 40 minutes without effect.
Resection of 4th and 5th cartilages. Eucain analgesia. 3 silk sutures	No drainage	Drainage	Peritonitis and mediastinitis	Died 7 days later; Heart stopped during operation and was revived by massage.
Resection of 5th, 6th and 7th cartilages. Chloroform. 3 silk sutures	No drainage	....	Bronchopneumonia	Died 5 days later of pneumonia. Heart wound found healed at autopsy.
Flap of 3rd, 4th and 5th ribs, hinge external. Pleura freely opened. Chloroform. 3 catgut sutures	Drainage	Posterior drainage in 8th space	....	Died 24 hours later. Clot found in tricuspid valve, probably the cause of death.
Flap of ribs, hinge external	....	....	Pericarditis. Syphilis	Died 17 hours later.
Resection of 5th, 6th, 7th, 8th and 9th cartilages. Pleura not opened. Chloroform. 4 sutures	Drainage	....	Pericarditis and pleuritis	Died 23 days later.
Skin flap; excision of 3rd and 4th cartilages. Chloroform. 1 catgut suture	....	....	....	Died on table.
Resection of 4th rib and cartilage. Ether. 4 chromic catgut sutures	Gauze drain	No drainage	....	Recovered.
Resection of 4th and 5th cartilages. Catgut sutures	Drainage	Drainage	....	Died next day from effects of hemorrhage.
Resection of 4th and 5th cartilages. Pleura freely opened. Chloroform. 5 silk sutures	No drainage	No drainage	Nonsuppurative pericarditis and pleuritis. Superficial abscess in wound	Recovered.
Resection of 4th and 5th cartilages. Pleura freely opened. No anæsthetic. 4 silk sutures	....	....	....	Died on table. Heart massage and direct infusion into ventricle without result
Resection of 3rd, 4th and 5th ribs. Chloroform. 2 silk sutures	No drainage	Drainage	Pericarditis and pleuritis	Died 60 hours later.
Resection of 3rd, 4th. 5th and 6th ribs. Chloroform. 5 silk sutures	No drainage	No drainage	Pericarditis and pleuritis	Died 13 days later.
Flap of 3rd, 4th, 5th and 6th right ribs, hinge external on right. Right pleura freely opened. Chloroform. 3 catgut sutures	No drainage	No drainage	Hemorrhage of 700 Gm. from a parietal vessel, into right pleura, after operation	Died 28 hours later. Infusion of 5 liters saline solution given during operation.

TABLE I—WOUNDS OF THE

No.	Operator. Year	Location and character of external wound. Sex. Age	Complicating injuries	Time between wounding and operation	Position and size of heart wound
28	Hesse 1905	Scissors wounds in 4th and 5th left spaces. Male; 25 yrs.	Left hæmothorax, large amount	¾ hour	Right vent. near apex. 1 cm.
29	Horodynski 1899	Stab wound in 3rd left space, 2 cm. from sternum. Female; 23 yrs.	Pleura and lung wounded, left hæmopneumothorax	1 hour	Right vent. lower third
30	Isnardi and Colombino 1902	Stab wound in sternum at articulation of 5th left costal cartilage	....	2 hours	Right vent. 1.5 cm.
31	Kosinski 1899	Stab wound in 3rd left space	....	....	Right vent.
32	Lastaria 1901	Stab wound in 5th left space, at border of sternum	....	½ hour	Right vent.
33	Lemaitre 1904	Poniard stab wound in 5th left space, near sternum. Male; 20 yrs.	Injury of diaphragm and left lobe of liver	1 hour	Right vent.
34	Lenormant 1905	Pistol-shot wound in 5th left space, at border of sternum. Male; 16 yrs.	Liver, stomach and intestine wounded	7 hours	Right vent. 15 to 20 mm.
35	Lisante 1899	Stab wound in 4th space, 1 cm. within nipple line	....	Very soon	Right vent.
36	Liscia 1901	Stab wound in 4th left space	....	....	Right vent.
37	Manteuffel 1903	Pistol-shot wound, 5. mm. in 4th left space	....	9 hours	Right vent. 5 mm.
38	Marion 1898	Pistol-shot wound in 4th left space, 3 cm. from sternum. Male; 55 yrs.	Pericardium distended with blood	2 hours	Right vent. perforated
39	Mignon et Sieur 1901	Stab wound in 4th left space, 2 fingers' breadth from nipple	Large amount of blood in pericardium	1 hour	Right vent. 1 cm.
40	Milesi 1902	Stab wound in 5th left space.	....	2 hours	Right vent. 1.5 cm.
41	Milesi 1903	Stab wound in 4th left space near sternum	....	1 hour	Right vent. 1 cm.

RIGHT VENTRICLE—*Continued*

Operative procedure. Anæsthetic. Sutures	Drainage		Course and postoperative complications	Result and remarks.
	Pericardium	Pleura		
Flap of 3rd and 4th ribs, hinge internal. Chloroform. 3 silk sutures.	Drainage	Drainage	Pericarditis and pleuritis	Recovered.
Resection of 3rd, 4th and 5th cartilages. Pleura freely opened. No anæsthetic. 3 deep and 2 superficial sutures	Drainage	Drainage	Pericarditis; double empyema	Died 3 weeks later of empyema.
Resection of 5th and 6th ribs, Chloroform. 3 sutures	....	Drainage	Empyema; subsequent drainage	Recovered.
5 sutures	....	....	....	Recovered.
Flap of 3rd, 4th, 5th and 6th cartilages, hinge internal. Chloroform. Silk sutures	....	Drainage	....	Died next day.
Flap of 3rd, 4th and 5th ribs, hinge external. Slight accidental tear in pleura. Chloroform. 3 catgut sutures	No drainage	Drainage	Empyema	Died 10 days later.
Flap of 4th, 5th and 6th ribs, hinge external. Chloroform. 3 silk sutures	Drainage	....	Syncope on table; heart massage and traction on tongue revived patient	Died 4½ hours later.
Flap of 4th and 5th ribs, hinge above. Chloroform. Silk sutures	No drainage	....	Signs of cardiac aneurism at end of 2 months	Recovered.
Flap of 2nd, 3rd, 4th and 5th ribs. No anæsthetic. 3 sutures	....	....	Pleuritis; nephritis	Died 42 hours later.
Resection of 4th, 5th, 6th and 7th cartilages. Ether. Silk sutures for both wounds	No drainage	Drainage	Pericarditis: pericardium aspirated 2 days after operation	Recovered. Bullet perforated anterior wall and lodged in posterior wall where it could be felt. Incision and extraction of bullet.
Resection of 6th and 7th cartilages and part of sternum. Ether. Wound of entrance sutured	....	....	....	Died on table.
Resection of 4th, 5th and 6th cartilages. Pleura not opened. Silk sutures	Drainage	Drainage	....	Died 2 hours later. Suicide during course of a grippe pneumonia.
Resection of 6th rib. Chloroform. 4 silk sutures; 1 deep and 3 superficial	Drainage	Drainage	....	Died 15 hours later; hemorrhage.
Resection of 4th cartilage. Chloroform. 3 silk sutures, 1 deep and 2 superficial	No drainage	Drainage	Pericarditis	Died 7 days later.

TABLE I—WOUNDS OF THE

No.	Operator. Year	Location and character of external wound. Sex. Age	Complicating injuries	Time between wounding and operation	Position and size of heart wound
42	Morestin 1903	Pistol-shot wound, 8 mm., through sternum opposite 4th costal cartilage. Male; 20 yrs.	....	21 hours	Right vent., one wound
43	Musumeci 1905	Stab wounds in 4th and 5th left spaces	Three intestinal wounds	Soon	Right vent.
44	Nanu 1900	Stab wounds in 3rd left space, 4 cm. from sternum	Pleura wounded	2 hours	Right vent. near apex, 2 cm.
45	Neumann 1905	Stab wound below left costal arch in parasternal line. Male; 53 yrs.	....	....	Right vent. admitted forefinger
46	Nicolai 1899	Stab wound in 4th left space, parasternal line	....	1½ hours	Right vent. near apex
47	Niebert 1901	Stab wound in 5th right space, at border of sternum. Male; 22 yrs.	Pleura not wounded	2 hours	Right vent. ½ inch
48	Nimier 1905	Stab wound in 4th left space, 1 cm. from sternum. Male; 26 yrs.	....	25 min.	Right vent. 1.5 cm.
49	Pecori 1903	Stab wound in 5th left space, within nipple line	....	....	Right vent.
50	Ramoni 1899	Stab wound over 5th left cartilage, 2 cm. from sternum	....	½ hour	Right vent. 2 wounds
51	Rehn 1897	Stab wound in 4th left space, 2 cm. from sternum. Male; 22 yrs.	Left hæmothorax, large amount	More than 24 hours	Right vent. 1.5 cm.
52	Rehn 1906	Stab wound in 4th left space; fell on knife. Male; 30 yrs.	....	8½ hours	Right vent.
53	Riche 1902	Stab wound in 4th left space, parasternal line. Female; 30 yrs.	....	2 hours	Right vent. 5 mm.
54	Savariaud 1902	Stab wound in 5th left space, 3 cm. from sternum	Border of lung wounded	....	Right vent. near apex
55	Savariaud 1904	Stab wound below and internal to left nipple. Female; 35 yrs.	....	2½ hours	Right vent.

RIGHT VENTRICLE—*Continued*

Operative procedure. Anæsthetic. Sutures	Drainage		Course and postoperative complications	Result and remarks.
	Pericardium	Pleura		
Resection through sternum. Chloroform. 4 catgut sutures	Drainage	Drainage	....	Died 19 hours later of embolism (?). Bullet found in cavity of right ventricle.
Flap; hinge internal. Ether and chloroform. Suture of heart and intestinal wounds	No drainage	....	....	Died 18 hours later.
Resection of 2nd, 3rd and 4th cartilages. 3 catgut sutures	No drainage	Drainage	Pericarditis and pleuritis	Died 4 days later.
Resection of 4th, 5th, 6th and 7th cartilages. Sutures tore out at first	Gauze tampon for hemorrhage	....	....	Died ¾ hours later; hemorrhage.
Resection of 4th and 5th cartilages. Anæsthetic. Wound sutured	....	....	....	Died 12 hours later.
Skin flap, base to left; partial resection of sternum. Pleura not opened. No anæsthetic. 3 silk sutures	....	....	Pericarditis	Died 33 hours later from pericarditis.
Flap of 4th, 5th and 6th ribs, hinge external. Pleura not opened. Chloroform. 4 catgut sutures	Drainage	Drainage	....	Died next day.
Flap of 5th and 6th ribs. Sutured; first sutures tore out	....	....	....	Died on table; hemorrhage.
Flap of 4th and 5th ribs hinge below. Chloroform. 4 sutures in one wound, 2 sutures in the other	....	Drainage	....	Recovered.
Resection of 5th cartilage. Chloroform. Silk sutures	Drainage	Drainage	Empyema; secondary drainage	Recovered.
Flap of 4th and 5th ribs, hinge internal. Pleura freely opened. Chloroform and ether. 10 silk sutures	No drainage	No drainage	Pleuritis; 900 c.c. of fluid aspirated from left chest the day after operation	Died 2 days later.
Flap of 3rd and 4th ribs, hinge external. Pleura freely opened. Chloroform. Wound sutured	No drainage	No drainage	No postoperative complications	Recovered.
Flap of 4th and 5th ribs, hinge external; pleura not opened. Chloroform. 3 sutures	....	....	Gangrene of border of lung	Died 52 hours later.
Flap of 3rd, 4th and 5th ribs, hinge external. Pleura freely opened. Chloroform. 3 catgut sutures	No drainage	No drainage	Pericarditis; pyopneumothorax	Died 14 days later.

TABLE I—WOUNDS OF THE

No.	Operator. Year	Location and character of external wound. Sex. Age	Complicating injuries	Time between wounding and operation	Position and size of heart wounds
56	**Schachowski**..... 1903	Stab wound in 6th left space, near nipple line	....	....	Right vent. 1.5 cm.
57	**Smith**........... 1904	Stab wound in 4th left space, 2 cm. from sternum. Male; colored; 22 yrs.	....	½ hour	Right vent.
58	**Soave**........... 1907	Stab wound in 5th left space, 4 fingers' breadth from sternum. Male; 19 yrs.	....	Very soon	Right vent.
59	**Steyner**........ 1903	Stab wound at about 5th rib near sternum	....	....	Right vent.
60	**Thiemann**....... 1906	Needle fixed at border of 4th rib, 31 mm. in tissues. Male; 23 yrs.	Wound of pleura; slight hæmopericardium, 100 c.c.	4 hours	Right vent. 1 cm. and right auricle 1.5 cm.
61	**Travers**........ 1906	Impaled on iron picket; wound through lower end of sternum. Male; 19 yrs.	Comminuted fracture of sternum	3 hours	Right vent. trifid wound; 2½ inches
62	**Vaughan**........ 1908	Stab wound in 4th left space, near nipple. Male; colored; 32 yrs.	Left lung and pleura wounded hæmothorax, 1 pint	1 hour	Right vent., lower part, ½ inch
63	**Vogel**.......... 1903	Stab wound in 4th left space, near sternum. Male; 16 yrs.	....	At once	Right vent. 1.5 to 2 cm.
64	**Walcker**........ 1900	Stab wound below left costal arch in parasternal line. Male; 53 yrs.	Wound of diaphragm and peritoneum	....	Right vent.
65	**Watten**......... 1900	Stab wound in 4th right space, near sternum	....	6 hours	Right vent. 2 cm.
66	**Watts**.......... 1908	Stab wound in 2nd left space, near sternum.	....	½ hour	Right vent. and root of pulmonary artery
67	**Weiss**.......... 1904	Stab wound	....	8 hours	Right vent.
68	**Wolff**.......... 1903	Stab wound. Male	....	Soon after injury	Right vent. 2 cm.
69	**de Zawadski**..... 1907	Stab wound	....	....	Right vent.

RIGHT VENTRICLE—*Continued*

Operative procedure. Anæsthetic. Sutures	Drainage		Course and postoperative complications	Result and remarks.
	Pericardium	Pleura		
Resection of 5th and 6th cartilages. 6 sutures	Drainage	....	....	Recovered.
Resection of 4th and 5th ribs and part of sternum. Ether. Continuous silk sutures	No drainage	Drainage	Pericarditis	Died 7 days later.
Flap of 4th and 5th ribs, hinge internal. Chloroform. Silk sutures	Drainage	....	No postoperative complications	Recovered.
Resection of 4th and 5th ribs. Chloroform. 4 sutures	Drainage	Drainage	....	Recovered.
Resection of 4th and 5th ribs. Chloroform. 1 catgut suture in ventricle, 4 catgut sutures in auricle	Drainage	Drainage	Pericarditis. Left pleuritis and empyema	Recovered.
Flap of 3rd, 4th and 5th cartilages and part of sternum; hinge below. Chloroform. 23 sutures in 3 rows.	Drainage	Drainage	No sepsis; death due to clot in pericardium from slow secondary hemorrhage	Died on 11th day after operation.
Flap of 4th, 5th and 6th cartilages, hinge internal. Pleura freely opened. Ether. 12 silk sutures in 2 rows	No drainage	No drainage	Delirium tremens	Recovered.
Resection of 4th and 5th cartilages. Chloroform. 5 silk sutures	No drainage	Drainage	Pericardium opened and drained on 2nd day; heart sutures finally expelled	Recovered.
Resection of 4th, 5th, 6th and 7th cartilages: Peritoneum opened. Sutured; stitch tore out	Wound packed with gauze	....	....	Died ¾ hour later.
Flap of 3rd and 4th right cartilages, hinge external, (to the right). Chloroform. 3 sutures	Drainage	Drainage	....	Recovered.
Resection of 2nd and 3rd ribs. Ether. Sutured.	No drainage	Drainage	....	Died one month later.
Resection of ribs, laparotomy Sutured	....	Drainage	Pleuritis	Died 15 days later.
Intercostal incision in 4th space. 3 continuous silk sutures	No drainage	No drainage	Pericarditis and pleuritis, Thoracotomy on 5th day for empyema	Died 14 days later.
Heart wound sutured	....	....	Pneumonia	Died 17 hours later of pneumonia

TABLE II—WOUNDS OF THE

No.	Operator. Year	Location and character of external wound. Sex. Age	Complicating injuries	Time between wounding and operation	Position and size of heart wound
70	ALVEZ DE Lima.. 1905	Stab wound over 4th left cartilage	Mitral valves wounded	Soon	Left vent. 14 mm
71	BARTH.......... 1901	3 stab wounds in 4th left space, 3 cm. from sternum. Male; 28 yrs.	....	¾ hour	Left vent. 0.5 cm.
72	BARDENHEUER... 1904 (?)	Gunshot wound	Interventricular septum penetrated; hemorrhage profuse	....	Left vent.
73	BORCHARDT...... 1904	Impaled on picket fence, fell from tree. Male; 12 yrs.	Hæmopneumothorax Abdominal injury suspected	2½ hours	Left vent. on posterior wall 1.5 cm.
74	BORZYMOWSKI ... 1903	Stab wound between ensiform and left cartilages. Male; 22 yrs.	....	....	Left vent. apex, 2 cm.
75	BRACHINI........ 1901	3 stab wounds in region of heart. Male; 27 yrs.	....	At once	Left vent. 2 wounds. One 1 cm., penetrating. One 3 mm.
76	BREZARD AND MOREL........	Pistol-shot wound, 8 mm. in 3rd left space, 2 cm. from sternum. Male; 19 yrs.	Wound of lung. Hæmopericardium, 100 c.c.	Soon	Left vent. 2 wounds. Cavity not opened
77	CAPPELEN 1896	Stab wound in 4th left space, midaxillary line	Pericardium distended with blood. Hæmothorax, 1400 c.c. lung compressed. Coronary artery found cut	1 hour	Left vent. 2 cm.
78	CARMELO........ 1904	Stab wound in 4th left space	....	....	Left vent.
79	DUVAL.......... 1906	Stab wound in 5th left space, 8 to 10 cm. from border of sternum. Male; 40 yrs.	Coronary vessels injured	Not known, found unconscious	Left vent. 1.5 cm.
80	FISCHER......... 1907	Stab wound in 3rd left space; another over 2nd rib. Male; 45 yrs.	....	1 hour	Left vent.
81	FITTIG.......... 1908	Pistol-shot wound in 3rd left space, internal to nipple. Male; 29 yrs.	Border of lung wounded; sutured	2 hours	Left vent. 2 wounds, ant. and post. 3 cm. and 1 cm.

LEFT VENTRICLE

Operative procedure. Anæsthetic. Sutures	Drainage		Course and postoperative complications	Result and remarks
	Pericardium	Pleura		
Flap of 3rd and 4th ribs, hinge external. Chloroform. 1 catgut suture	No drainage	Drainage	....	Died one hour later; hemorrhage. Heart stopped twice during operation and was revived by massage.
Flap of 4th and 5th cartilages, and sternum, hinge on the right. Chloroform. 3 silk sutures	No drainage	Drainage	....	Recovered.
Sutured	....	....	Pericarditis; septic pleuritis	Died ten days later.
Incision over 5th rib from sternum to axilla. Exploratory laparotomy. 4 silk sutures	Drainage	Drainage	....	Recovered.
Wound enlarged, resection of 4th, 5th and 6th ribs. No anæsthetic. 3 deep and 3 superficial sutures	....	....	Suppurative pericarditis and pleuritis	Died 2 days later.
Flap of 3rd, 4th and 5th ribs, hinge internal. No anæsthetic. Penetrating wound closed by 2 sutures	....	....	....	Died on table.
Flap of 3rd, 4th and 5th ribs, hinge external. Chloroform. Both wounds sutured with catgut	No drainage	....	....	Died on table from hemorrhage. Heart massage tried ineffectually.
Resection of 3rd and 4th cartilages. Ether. Sutured	....	....	Pericarditis	Died 3 days later of pericarditis.
Resection of 4th and 5th cartilages. Chloroform. Silk sutures	....	Drainage	Bronchopneumonia	Died 3 days later.
Flap of 4th, 5th and 6th ribs, hinge external. Pleura freely opened. No anæsthetic. 2 interrupted sutures	....	....	....	Died on table. Direct infusion of warm salt solution into ventricle after heart had stopped, revived it for a short time.
Wound enlarged; excision of 3rd and 4th cartilages. Ether. 3 silk sutures	Drainage	Drainage	Pericarditis	Died 30 hours later.
Intercostal incision in 4th space; resection of 4th and 5th ribs. 6 catgut sutures in anterior wound	Gauge drain	Large drain	....	Died 24 hours later; anæmia. Wound of exit did not bleed; not sutured.

TABLE II—WOUNDS OF THE

No.	Operator. Year	Location and character of external wound. Sex. Age	Complicating injuries	Time between wounding and operation	Position and size of heart wound
82	FONTAN 1900	Six scissors wounds between 3rd and 7th left ribs. Male; soldier	...	6½ hours	Left vent. 12 mm.
83	FONTAN 1901	Stab wound in 4th left space, 0.5 cm. outside nipple. Male; soldier	...	2 hours	Left vent. 8 mm.
84	de FOURMESTRAUX 1905	Stab wound—finger's breadth outside left nipple. Male; 24 yrs.	Hæmothorax, large amount, hæmopericardium, 300 c.c.	½ hour	Left vent. 5–6 cm. above apex
85	de FOURMESTRAUX 1905	Stab wound in 4th left space. Male; 23 yrs.	...	10 minutes	Left vent. extending to right vent. 3 cm.
86	FUMMI 1898	Stab wound below left nipple	Pericardium distended with blood. Extensive hæmothorax	Some hours	Left vent. apex. Non-penetrating
87	GENTIL 1901	3 stab wounds in 4th left space	...	10 hours	Left vent. 1 cm.
88	GERZEN 1902	Stab wound in 5th left space	...	...	Left vent.
89	GIORDANO 1902	Stab wound in 6th left space	...	...	Left vent. 2 cm.
90	GIORDANO 1902	Stab wound in 3rd, 4th and 5th left spaces, near nipple	...	...	Left vent. 2 cm.
91	GOEBELL 1906	Pistol-shot wound, 7 mm. in 3rd left space, 2 cm. from sternum. Male; 23 yrs.	Hæmothorax, large amount. Hæmopericardium, 100 c.c. Lung wounded; sutured with catgut	1 hour	Left vent. 2 wounds. 2 cm.
92	GREKOW AND ZEIDLER 1903	Stab wound in 2d left space, 5 cm. from sternum. Male; 25 yrs.	Hæmopneumothorax	3 hours	Left vent. 0.5 cm.
93	GUENOT 1904	Stab wound in 4th left space. Female; 20 yrs.	Hæmothorax, 1½ liters	1½ hours	Left vent. near apex. 1.5 cm.
94	GUINARD 1904	Stab wound in 4th left space, within nipple line	Hæmothorax, large amount	1½ hours	Left vent.
95	HENRIKSEN 1902	Stab wound in 3d left space, 2.5 cm. from sternum	...	...	Left vent. 1.5 cm.
96	HESSE 1905	Stab wound in 4th left space, near sternum. Male; 13 yrs.	Hæmothorax, large amount	¾ hour	Left vent. ¾ cm.

LEFT VENTRICLE—*Continued*

Operative procedure. Anæsthetic. Sutures	Drainage		Course and postoperative complications	Result and remarks
	Pericardium	Pleura		
Flap of 4th, 5th and 6th ribs, hinge external. Chloroform. Continuous catgut sutures	No drainage	No drainage	Pleuritis	Recovered.
Flap of 4th, 5th, and 6th ribs hinge external. Chloroform. Continuous catgut sutures	No drainage	No drainage	Pleuritis; emboli in right lung	Died 5 months later from brain abscess.
Flap of 3rd, 4th and 5th ribs, hinge internal. Pleura freely opened. 3 silk sutures	No drainage	No drainage	Pleuritis; secondary drainage 6 days later	Recovered.
Flap of 3rd, 4th and 5th ribs, hinge internal. Pleura freely opened. Chloroform. 3 silk sutures	....	....	....	Died on table. Autopsy showed a wound of interventricular septum.
Resection of 5th rib. Anæsthesia. 1 suture.	....	....	Empyema	Recovered.
Flap of 4th and 5th cartilages, hinge internal. Chloroform. Silk sutures	Drainage	Drainage	....	Died 5 days later.
Resection of 5th and 6th ribs. Chloroform. Sutured	No drainage	Drainage	Pericarditis; pleuritis; nephritis	Died 53 days later.
Flap of 4th and 5th ribs, hinge internal. 2 silk sutures	No drainage	Drainage	....	Died 1½ hours later.
Flap of 4th and 5th ribs, hinge external. 2 silk sutures	No drainage	Drainage	Autoplastic operation required to close opening	Recovered.
Flap of 3rd to 7th ribs, hinge external. 9 catgut sutures, 4 in one wound, 5 in the other	Small gauze drain	Gauze drain at lower angle of flap	No complications	Recovered.
Resection of 3rd and 4th ribs. Pleura freely opened. Chloroform. Silk sutures	No drainage	No drainage	Pleuritis, mild	Recovered. Well 10 months later.
Flap of 3rd, 4th, 5th and 6th ribs, hinge internal. Pleura freely opened. Ether. 3 catgut sutures	No drainage	Drainage	Pleuritis	Died 53 hours later.
Flap of 3rd, 4th, 5th and 6th ribs, hinge external. Pleura freely opened. Chloroform. Catgut sutures	No drainage	Drainage	....	Died 18 hours later.
Resection of 3rd and 4th ribs. Sutured	....	....	....	Died 16 hours later.
Flap of 3rd and 4th ribs, hinge internal. Pleura freely opened. Chloroform. 3 silk sutures	Drainage	Drainage posteriorly by resection of rib	Pericarditis and pleuritis	Recovered.

TABLE II—WOUNDS OF THE

No.	Operator. Year	Location and character of external wound. Sex. Age.	Complicating injuries	Time between wounding and operation	Position and size of heart wound
97	HILL............ 1902	Male; colored, 13 yrs.	Hæmopericardium, 10 oz.	....	Left vent. near apex, ⅜ inch.
98	JANARI.......... 1903	Stab wound in 3d left space	Hæmopericardium; heart tamponade	1 hour	Left vent. 1 cm.
99	LAUNAY 1901	Pistol-shot wound, 7 mm. 1 at left nipple. Male; 26 yrs.	Hæmothorax, large amount. Lung wounded	4 hours	Left vent. 2 wounds, entr. and exit
100	LEMAITRE....... 1903	Stab wound in 4th left space, below and internal to nipple. Male; 40 yrs.	Hæmothorax, large amount	1⅓ hours	Left vent. 4 cm.
101	LONGO.......... 1899	Stab wound in 5th left space, 1 cm. outside nipple	....	½ hour	Left vent.
102	MALIZEWSKI..... 1899	Stab wound in 5th left space, in nipple line. Male; young laborer	Wound of pleura and lung; hæmothorax	¼ hour	Left vent. near apex, 2½ cm.
103	MALIZEWSKI..... 1899	Stab wound in 3d left space, outside nipple line. Male; 24 yrs.	Hæmopneumothorax	¼ hour	Left vent. 1 cm.
104	MASELLI......... 1900	Stab wound through 6th rib, below and within left nipple	....	1½ hours	Left vent. near apex
105	MUSUMECI....... 1908	Stab wound in 5th left space, internal to nipple line. Male; 18 yrs.	....	Not stated	Left vent. near apex, 1 cm.
106	NIETERT......... 1901	Stab wound in 6th left space, inside nipple line. Male; colored, 27 yrs.	Hæmothorax, 1½ pint	14½ hours	Left vent. admitting finger
107	NINNI........... 1898	Stab wound in 5th left space	....	At once	Left vent. admitting finger
108	NOLL............ 1903	Pistol-shot wound in 1st left space, 7 mm.	....	1½ hours	Left vent.
109	PAGENSTECHER .. 1899	Stab wound below and within left nipple	....	16 hours	Left vent. 3.5 cm.
110	PARLAVECCHIO... 1898	Stab wound in 5th left space	....	8 hours	Left vent. near apex, 3.5 cm.
111	PAROZZANI....... 1897	Stab wound in 7th left space, in nipple line	Left pleura filled with blood	5 hours	Left vent. near apex, 2 cm.
112	PAROZZANI 1897	Stab wound in 3d left space	Wound of interventricular septum	1½ hours	Left vent. 1.5 cm.

LEFT VENTRICLE—*Continued*

Operative procedure. Anæsthetic. Sutures	Drainage		Course and postoperative complications	Result and remarks
	Pericardium	Pleura		
Flap of 3rd, 4th and 5th ribs, hinge internal	....	....	....	Recovered.
Flap of 3rd, 4th and 5th ribs, hinge internal. Chloroform. Sutured	Drainage	Drainage	Pleuritis	Died 3 days later.
Flap of 4th, 5th and 6th ribs, hinge external, Pleura freely opened. Chloroform. Both wounds closed with catgut sutures	Drainage	Drainage	....	Recovered.
Flap of 3rd, 4th and 5th ribs, hinge external. Pleura freely opened. Chloroform. 5 catgut sutures	No drainage	Drainage. 2 large drains	....	Died 9 hours later of hemorrhage and shock.
Flap of 4th and 5th ribs, hinge above. None. 3 silk sutures	....	....	....	Died on table.
Resection of 4th, 5th and 6th ribs. None. 3 silk sutures	No drainage	Gauze drainage	....	Died 26 hours later.
Resection of 3rd rib. None. 3 silk sutures	Gauze drainage	Gauze drainage	Purulent pericarditis. Pleuritis	Died 4 days later from purulent pericarditis
Resection of 6th rib. No anæsthetic. 2 sutures	No drainage	Gauze drainage	....	Died 12 hours later.
Triangular flap turned downward, cutting 5th and 6th cartilages. Pleura freely opened. Ether and chloroform. Silk sutures	Gauze drainage	Drainage	Purulent pericarditis. Pleuritis	Died 12 days later from secondary hemorrhage, due to suppuration in myocardium.
Flap of 5th and 6th ribs, hinge internal. Pleura freely opened. Chloroform. 2 silk sutures	Drainage	Drainage	Empyema; thoracotomy 24 days later. Infection of wound	Recovered.
Flap of 4th and 5th ribs, hinge internal. No anæsthetic. 3 sutures	....	....	....	Died on table.
Sutured	Drainage	Drainage	Pleuritis	Recovered.
Resection of 5th cartilage. Ether. 3 deep and 1 superficial suture	No drainage	Drainage	Pleuritis	Recovered.
Resection of 5th rib. Chloroform. 4 sutures	No drainage	No drainage	....	Recovered.
Flap of 5th, 6th, 7th and 8th cartilages, hinge internal. No anæsthetic. 4 silk sutures	No drainage	No drainage	No complications	Recovered.
Flap of 4th, 5th and 6th ribs, hinge internal. No anæsthetic. 2 sutures	No drainage	No drainage	....	Died 48 hours after.

TABLE II—WOUNDS OF THE

No.	Operator. Year	Location and character of external wound. Sex. Age	Complicating injuries	Time between wounding and operation	Position and size of heart wound
113	PICONE.......... 1904.	Stab wound 2 fingers' breadth below left nipple	....	Very soon	Left vent.
114	POMARA......... 1902	Stab wound in 6th left space below nipple	....	....	Left vent. near apex
115	QUENU.......... 1906	Stab wound in 3d left space, near sternum. Female; 19 yrs.	Pericardium distended with blood. Only a little blood in pleura	2½ hours	Left vent., upper part
116	RENON.......... 1902	Stab wound in 4th left space, 4 cm. internal to nipple. Male; 23 yrs.	Hæmopericardium; large amount	½–1 hour	Left vent. apex
117	RIBAS y RIBAS... 1905	Stab wound in 3d left space, 3 cm. from sternum	....	About 1 hour	Left vent. 1 cm.
118	RICHE........... 1904	Pistol shot wound, 8 mm. 5 cm. within and 2 cm. below left nipple. Male; 24 yrs.	Wound of diaphragm, spleen and lung. Very extensive hæmothorax	1½ hours	Left vent. 2 wounds
119	ROSA............ 1899	Stab wound in 5th left space	Wound of lung	At once	Left vent. near base. 1.5 cm.
120	ROTHFUCHS...... 1905	Bullet wound. Male; 25 yrs.	Wound of stomach and diaphragm. Hæmopneumothorax	....	Left vent. perforated
121	SENNI........... 1905	Stab wound in 6th left space, in nipple line	....	....	Left vent. 3 cm.
122	SOMERVILLE 1904	Stab wounds in 4th and 5th left spaces within nipple line. Male	Hæmopneumothorax	55 minutes	Left vent. ragged wound ⅜ inch
123	STEWART, F. T. 1902	Stab wound in 4th left space, ½ inch from sternum	....	Immediately	Left vent. ⅝ in.
124	STEWART, F. T... 1904	Stab wound in 2d left space, 1 inch from sternum. Male, colored; 20 yrs.	Coronary artery injured during suture. Edge of lung wounded	¾ hour	Left vent. ¾ inch.
125	STEWART, G. D... 1902	Stab wound in 5th left space, ½ in. outside nipple	....	1½ hours	Left vent. ¾ inch.
126	STUDE........... 1904	Stab wound in chest. Male	....	2 hours	Left vent. 2.5 cm.
127	SULTAN, C....... 1905	2 stab wounds in 5th left space, 2 cm. within nipple line	Hæmothorax. 1 liter. Wound of right ventricle found at autopsy	....	Left vent. 7 mm.

LEFT VENTRICLE—*Continued*

Operative procedure. Anæsthetic. Sutures	Drainage		Course and postoperative complications	Result and remarks
	Pericardium	Pleura		
Flap of 3rd, 4th and 5th ribs, hinge internal. Sutured	Drainage	Drainage	Hemorrhage into right pleura	Died 2 days later.
Resection of 5th and 6th ribs. No anæsthetic. Silk sutures	No drainage	Drainage	Pericarditis and pleuritis	Died 73 hours later.
Flap of 3rd, 4th and 5th ribs, hinge external. Pleura freely opened. Chloroform. 2 sutures	No drainage	No drainage	Syncope on table; traction on tongue revived her	Recovered. Left hospital against advice 12 days after operation.
Resection of 4th and 5th ribs. Chloroform. 4 catgut sutures	....	....	....	Died next day; hemorrhage.
Flap of 4th, 5th and 6th ribs, hinge external. 3 sutures	Drainage	Drainage	....	Died 72 hours later.
Flap of 3rd, 4th and 5th ribs, hinge external. Pleura freely opened. Chloroform. Both wounds sutured with catgut	....	....	....	Died on table.
Resection of 5th rib. Flap of 6th, 7th and 8th ribs, hinge below. No anæsthetic. 1 suture	Drainage	Drainage	....	Recovered.
Resection of 4th and 5th ribs. Both wounds sutured with catgut	Gauze drainage	Drainage	Peritonitis	Died 24 hours later.
Flap of 4th, 5th and 6th cartilages and part of sternum. Chloroform. 6 sutures	No drainage	Drainage	....	Died 3 days later.
Skin flap and intercostal incision in 4th space, not cutting ribs. Ether. 3 silk sutures	Gauze drainage	Drainage	No complications	Recovered.
Ether. 6 catgut sutures	....	....	....	Died 3 days later.
Skin flap hinged external. Flap of 3rd and 4th ribs, hinge internal. 6 continuous silk sutures	Gauze drainage	Gauze drainage	Pneumonia. Wound infection	Recovered.
Resection of 5th rib. Chloroform. 6 sutures	Drainage	Drainage	Pericarditis and pleuritis	Died 2½ days later.
Flap of 4th and 5th left cartilages and part of sternum, hinge on the right. Sutured	....	....	....	Died on table; death attributed to pneumothorax.
Flap of 5th, 6th and 7th ribs, hinge external. 4 sutures	No drainage	No drainage	....	Died 48 hours later.

TABLE II—WOUNDS OF THE

No.	Operator. Year	Location and character of external wound. Sex. Age	Complicating injuries	Time between wounding and operation	Position and size of heart wound
128	SULTAN, C....... 1906	Stab wound in 2d left space, 1 finger's breadth within nipple line	Hæmopericardium, 300–400 c.c.	5 days	Left vent.
129	SULTAN, G....... 1907	Pistol shot wound, 9 mm. in 5th left space, inside nipple line. Male; 38 years	Hæmopericardium, 200 c.c.	30 hours	Left vent. non-penetrating. 1½ cm.
130	TIKHOFF......... 1908	Stab wound with long, bent shoemaker's needle, outside nipple line. Male; 55 yrs.	Hæmopericardium; marked heart tamponade	1¼ hours	Left vent. posterior aspect
131	TSCHERNIACHOWSKI........... 1904	Stab wound in 4th left space, 1 finger's breadth internal to nipple. Male; 24 yrs.	Wound in lung; sutured	Less than 1 hour	Left vent. 5 cm. above apex. 1.5 cm.
132	TUZZI........... 1899	Stab wound in 4th left space near sternum	....	....	Left vent. 2 wounds, one penetrating
133	VAUGHAN........ 1901	Stab wound dividing 5th costal cartilage. Male, colored; 23 yrs.	2000 c.c. of blood in pleura and pericardium	¾ hour	Left vent. 2½ cm.
134	VELO........... 1902	Stab wound in 6th left space in nipple line. Male; 56 yrs.	Pleura filled with blood. Hæmopericardium, large amount	½ hour	Left vent. apex non-penetrating. 1.5 cm.
135	VIDAL.......... 1908	Bullet wound (Flobert rifle) in 4th space, 10 cm. from median line. Male; 11 yrs.	....	1¼ hours	Left vent.
136	VINCE.......... 1903	Stab wound in 5th left space	....	12 hours	Left vent.
137	WALCKER........ 1900	20 stab wounds, most of them in 4th left space	Extensive hæmothorax	4 hours	Left vent. 2 wounds, 8 heart wounds in all
138	WEINLECHNER... 1904	Stab wounds in 3d and 4th left spaces, within nipple line. Male	....	Very soon	Left vent. 2 wounds, 5 mm.
139	WENDEL......... 1905	Stab wound in 4th left space near sternum. Male; 19 yrs.	....	5 hours	Left vent.
140	WENNERSTROM .. 1903	Wound from fragment of glass in 3d left space, near sternum	....	2 hours	Left vent. 2 cm.
141	WILMS.......... 1906	Pistol shot wound, 6 mm.	Wound of lung, perforating, both wounds sutured. Hæmothorax. 1¼ liters	2 hours	Left vent. perforated
142	DE ZAWADSKI.... 1907	Stab wound	....	....	Left vent. posterior face
	RIMANN 1909	Gunshot wound perforating 3d rib. Male; 20 yrs.	Hæmopericardium; 100 c.c. Heart tamponade	1¼ hours	Left vent.

LEFT VENTRICLE—*Continued*

Operative procedure. Anæsthetic. Sutures	Drainage		Course and postoperative complications	Results and remarks
	Pericardium	Pleura		
Flap of 3rd, 4th and 5th ribs, hinge internal. Silk sutures; first tore out, others placed farther from edge	Drainage	No drainage	....	Recovered.
Flap of 4th and 5th left cartilages and part of sternum; hinge on the right. Pleura not opened. Chloroform. 3 silk sutures	....	....	No complications	Recovered.
Resection of 4th and 5th ribs. Pleura opened. Anæsthesia (very light). One suture	Edges sutured to skin; packed with gauze	....	Slight suppuration in pericardial wound	Recovered. Left hospital completely healed 26 days after operation.
Wound enlarged; 4th cartilage and part of sternum resected. Pleura opened. Chloroform. 3 silk mattress sutures	Iodoform gauze drain	Gauze tampon	No complications	Recovered. Left hospital 6 weeks after operation.
Resection of 4th and 5th ribs. No anæsthetic. Sutured	No drainage	Drainage	Pericarditis, serofibrinous empyema	Died 22 days later.
Flap of 4th and 5th ribs, 7 cm. wide, hinge upward. Ether. 7 continuous silk sutures	....	....	....	Died on table; hemorrhage.
Resection of 5th and 6th ribs. Pleura freely opened. 3 catgut sutures	Drainage	Drainage	Pleuritis	Died 3 days later. Autopsy: myocardium soft and hypertrophied.
Incision in 3rd left space, without resecting ribs, under positive pressure. Pleura freely opened. Ether. 2 sutures	No drainage	No drainage	....	Recovered.
Flap of 5th, 6th and 7th ribs. Chloroform. 3 silk sutures	No drainage	....	....	Died next day.
Resection of 4th rib. 11 silk stitches	Drainage	Drainage	....	Died 1½ days later.
Resection of 5th rib. Chloroform. Silk sutures	Drainage	Drainage	Pericarditis and pleuritis	Died 49 hours later.
Flap of 4th and 5th cartilages, hinge external. Pleura not opened. Chloroform. 1 catgut suture	Drainage	....	Pericarditis	Recovered.
Resection of 4th, 5th and 6th cartilages. 1 catgut and 4 silk sutures	No drainage	Drainage	3 gauze sponge pads left in pleura; removed on 14th day	Recovered.
Intercostal incision in 4th space. Both wounds sutured. 3 sutures in each	No drainage	No drainage	No complications	Recovered.
Ether. Sutured	Drainage	....	Suppurative pericarditis. Wound infection	Died 15 days later from secondary hemorrhage, due to suppuration in heart wound.
Resection of 4th and 5th cartilages. Ether. 5 silk sutures	No drainage	No drainage	Serous pleuritis; aspiration 12 days after operation	Recovered.

TABLE III—WOUNDS

No.	Operator. Year	Location and character of external wound. Sex. Age	Complicating injuries	Time between wounding and operation	Position and size of heart wound
143	GENTIL 1901	Male; 28 yrs.		5 hours	Right auricle. 1 cm.
144	GIORDANO 1898	Stab wound in 2d left space		½ hour	Left auricle. 2 cm.
145	GIULANIO 1903	Stab wound in 3d left space in nipple line			Left auricle
146	HARTE 1906	Stab wound in 3d left space			Left auricle. ½ inch
147	KAPPELER 1904	Stab wounds over 3d rib and in 3d left space		2½ hours	Left auricle. 1 cm.
148	NINNI 1901	Stab wound in 3d left space, near parasternal line	Hæmopericardium, large amount	½ to 1 hr.	Right auricle near auriculo vent. groove. 2.5 cm.
149	PECK 1908	Stab wound through 3d left cartilage at border of sternum. Female, colored; 23 yrs.	Two superficial stab wounds. Hæmopericardium; marked heart tamponade	¾ hour	Right auricle. 1 cm.
150	SCHWERIN 1903	Sharp pointed body entered 4th left space		¾ hour	Right auricle
151	THIEMANN 1906	Needle 31 mm. in tissues, fixed at upper border of 4th rib. Male; 23 yrs.	Hæmopericardium, 100 c.c.	4 hours	Right auricle. 1.5 cm. Right vent. 1 cm.
152	WILMS 1907	Stab wound. Male; 27 yrs.	Hæmothorax, 3 pints. Hæmopericardium, 50 c.c.	16 hours	Left auricle
	*DUFFY 1908	Stab wound dividing 4th cartilage. Male; 23 yrs.	Wound of lung and pleura. Hæmopneumothorax	½ hour	Right auricle. ½ inch

* Personal communication from Dr. Edward F. Duffy, Yonkers, N. Y. (unpublished).

TABLE IV—MISCELLANEOUS

153	BARDENHEUER 1904 (?)	Gunshot wound			Heart perforated
154	BORZYMOWSKI 1903	Stab wounds over 5th left cartilage. Male; 19 yrs.	Wound of pleura; sutured		3 heart wounds
155	BRACHINI 1901	Stab wound in 4th left space, 3 cm. outside nipple. Male; 15 yrs.	Hæmopericardium, large amount	Soon	Interventric groove. 2 cm.
156	MAUCLAIRE 1903	Stab wound, of left breast, 3 cm. from sternum			Heart wound
157	PAGENSTECHER 1901	Stab wound in 4th left space, 1 cm. from sternum. Male; 30 yrs.		2½ hours	Left coronary artery divided
158	SCHUBERT 1904	Bullet wound in 4th left space		½ hour	2 heart wounds, one anterior and one posterior
159	ZIEMBISKI 1903	Stab wound			Heart wound

OF THE AURICLES

Operative procedure. Anæsthetic. Sutures	Drainage		Course and postoperative complications	Result and remarks
	Pericardium	Pleura		
....	....	....	....	Recovered.
Flap of 3rd and 4th ribs, hinge below. No anæsthetic. 4 silk sutures	No drainage	Drainage	Left pleuritis. Right pulmonary abscess	Died 18 days after operation.
Flap of 3rd and 4th ribs, hinge external. Sutured with silk	Drainage	Drainage	....	Recovered.
Resection of 3rd and 4th cartilages. Ether. Catgut sutures	No drainage	Drainage	Pleuritis. Double pneumonia	Died 24 days after operation
Flap of 3rd and 4th ribs, hinge internal. Ether. Sutured	....	Drainage	Pleuritis	Recovered.
Resection of 4th and 5th cartilages and part of sternum. No anæsthetic. 3 sutures	Drainage	Drainage	Pericarditis and pleuritis	Died 3 days later.
Flap of 3rd, 4th and 5th ribs, hinge external. Resection of part of sternum. Pleura not opened. Ether. 4 chromicized catgut sutures	No drainage	No drainage	Pleuritis, mild, non-suppurative	Recovered.
Resection of 4th and 5th cartilages. 3 silk sutures	Drainage	Drainage	Pericarditis, pleuritis and pneumonia	Recovered.
Resection of 4th and 5th ribs. Chloroform. 4 catgut sutures in auricle, 1 catgut suture in ventricle	Drainage	Drainage	Pericarditis, pleuritis and empyema	Recovered. Case also included in table of right ventricle wounds No. 60.
Intercostal incision in 3rd space, resection of 1⅜ inch of 3rd rib	Drainage	No drainage	Pericarditis, pleuritis and empyema	Recovered. Out of bed in 3 weeks.
Quadrangular flap of 3d, 4th and 5th ribs, hinge external. Ether. 3 plain catgut sutures	No drainage	No drainage	Septic pericarditis; double pleuritis; pneumonia	Died 19 days later of general sepsis.

HEART WOUNDS

Both entrance and exit wounds sutured	....	....	Pericarditis and pleuritis	Died 3 days later.
Ether. All three wounds closed with silk sutures	....	....	Severe sepsis; suppurative pericarditis; discharge of silk sutures. Empyema—thoracotomy, 3rd rib, 6 months later	Recovered.
Flap of 2nd, 3rd, 4th and 5th ribs, hinge internal. Pleura opened. No anæsthetic. 5 silk sutures	....	Drainage	Pericarditis and pleuritis, purulent	Died 42 hours later, due to infection of pleura and pericardium.
Flap of 3rd and 4th ribs. 3 sutures	Drainage	Drainage	....	Died 24 hours later.
Flap of 4th and 5th cartilages, hinge internal. Ether. Both ends of divided artery secured with sutures	....	....	Pericarditis and pleuritis	Died 4 days later.
Resection of 4th rib. Chloroform. Both wounds sutured with catgut	....	....	....	Recovered. Operator thought bullet went through interventricular septum without opening either ventricle.
Sutured	....	....	....	Died.

teriorly by separate rib resection as in empyema, and not through the operative wound. If the lung is collapsed from the pneumothorax, aspiration drainage could be employed.

Careful suture of the soft parts should be made to prevent the sucking in of air through accidental or intentional operative wounds of the pleura. Any attempt to draw conclusions as to the effect of drainage as regards infection in reported cases seems rather hopeless, as the percentage of infected cases in the drained and the non-drained cases does not differ greatly. The fact that so large a percentage of the fatal cases (more than 60 per cent.) have escaped the first danger of hemorrhage and shock, and have succumbed later from other causes, generally of infective origin, leads to the hope that the future will show a substantial diminution in the mortality of cases operated upon.

Already one recent heart wound has been sutured under positive pressure (Vidal, Case 136).

Resection of a portion of one or more ribs without flap formation has been frequently done with satisfactory results.

The quadrangular flap with hinge external and *the long intercostal incision* with division of one or more cartilages at their sternal attachments, seem to me the best methods. For wounds far to the right, removal of a part of the sternum could be added to either method.

To gain sufficient experience by operations upon the human subject is out of the question. It is necessary, therefore, for every surgeon to whom such an opportunity may come, to be prepared to meet it at a moment's notice. A well formed plan of action, rehearsal of the technic if possible on the cadaver, together with the knowledge to be gained by the study of original case reports and experimental work, will be of inestimable value to the surgeon who may be called upon to meet this important emergency.

NOTE.—No attempt has been made to analyze exhaustively all the facts contained in the Tables, page 108 to 129. References are given as completely as possible to original case reports, which are replete with interesting and instructive details quite worthy of perusal. Cases incorrectly included or reduplicated in previously published series have been excluded as far as possible; *e.g.*, the case of Brenner, which has been published as three separate cases credited to Brenner and Zulehener. No effort has been made to include in the Bibliography all important contributions to the subject of heart surgery.

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THE OPERATIVE TREATMENT OF TUBERCULOSIS OF THE LUNGS WITH TOTAL THORACOPLASTIC PLEUROPNEUMOLYSIS.*

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If I presume to discuss before this illustrious assembly the subject of the operation of lung tuberculosis, it is because the matter is comparatively new on the one hand, while on the other it has provided me with a measure of personal experience such as to justify one in claiming the interest of wider professional circles for this pending problem. Having availed myself of various opportunities in Germany, for this purpose, I appreciate it as an especial distinction and privilege now to submit our experience.

Through an especially favorable coincidence, I had been engaged for several years upon experimental studies concerning the compensation of space in the thoracic cavity after the removal of an entire lung, while my colleague of the Internal Department, Professor Brauer, in his detailed studies of the treatment of tuberculosis with artificial pneumothorax, felt the necessity of more radical surgical measures.

In these experiments, I showed not only that the ablation of one lung is readily tolerated by animals immediately after the interference, but I ascertained also their excellent condition later, in regard to increase in body weight and further growth. The most important feature of these experiments was, that when the animals were killed, a long time after (one to one and a half years), the cavity caused by the removal of the lung was found to have become perfectly compensated—the heart taking the place of the pulmonary defect, in right-sided as well as left-sided amputation of the lung; and also that the remaining lung shows not only an increase in volume, but in a small portion even fills the defect left by the heart on the amputated side (Fig. 1). Moreover, the diaphragm at the site of the operation helped to diminish the defect, by rising higher up. The ribs on the operated side undergo atrophy, without a rib having been injured at the operation, to such an extent that the chest-wall itself *helps to diminish the defect by becoming flattened and shrunken.* I present a series of corresponding photographs, so that those among you who are interested in this matter, may inspect the specimen photographs directly.

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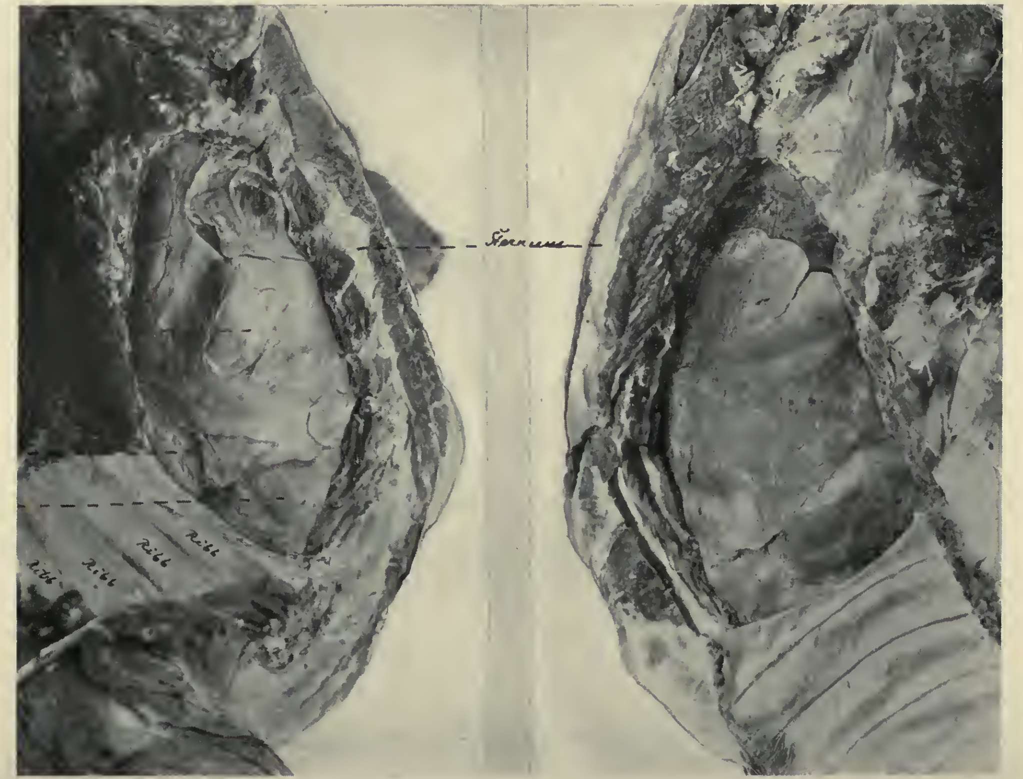
* Read before the American Surgical Association, June 4, 1909.

In addition to this, I was enabled to observe, in my former clinic in Greifswald, in a patient with extensive tuberculosis of the lungs and ribs, a favorable influence upon the pulmonary tuberculosis which astonished myself and my assistants, after ablation of almost the entire bony wall of the thorax on the diseased side. Thereupon, when my colleague in internal medicine referred to me cases in which pneumothorax therapy proved a failure on account of mutual adhesions of the pleural layers, we determined, after reviewing the various possibilities of surgical intervention, to assist the tendency of a still youthful lung toward shrinkage, with tuberculous cavernous destructive processes, in such a way that I de-ossified, as it were, the thoracic wall by ablating the ribs from the second to the tenth, from the spinal column as far as the costal cartilage at the sternum, the lung thus being made to collapse towards the hilus.

The course of our procedures was described last year, in an article published in *Surgery, Gynæcology and Obstetrics.* At the present day I am in a position to look back upon a measure of experience which permits me to outline more sharply the indications for this interference; to state how its dangers are most efficiently managed; and, finally, to specify the total results of the operation.

In adopting this course we stood by no means alone, but

FIG. 1.



Total amputation of the right lung. Dog, killed one year and a half after the operation. Right side of the thorax contains the heart, a little part of the left lung and diaphragm. Left side of the thorax contains only the left lung.

(as I have always pointed out in grateful acknowledgment of their scientific and practical preliminary labors) Quincke, Spengler, Turban, and Landerer had previously suggested that in all cases of unilateral phthisis showing a tendency to shrinkage of the lung, or over cavernous lung segments in general, the natural mechanism of the shrinking process, that caused the lung which was maintained at a certain rigid tension, to collapse through the removal of the ribs should be further reckoned with.

The same idea underlies the attempts of Forlanini, Murphy, Lemcke and Schell, Brauer, and A. Schmidt, to induce a restriction in the volume of the lung through the production of artificial pneumothorax.

The ablation of the bony chest wall must be carried out rapidly and accurately,—and this act can be completed within thirty to forty minutes, under employment of very small amounts of anæsthetic (0.015 morphine, local anæsthetic injections, and 6–10 gr. chloroform). The atmospheric pressure on the elastic chest wall now merely consisting of soft parts, then leads immediately to a very complete collapse-effect upon the lung, similar to pneumothorax. Only in case the lung contains calcified or dense fibrous masses in its interior, or when a former pleuromediastinitis has raised a sort of solid resistant rampart in a mesial direction, is the immediate retraction of the lung not so evident. Also the reaction upon the heart, in regard to displacement as well as change of the pulmonary circulation, is not so marked in these cases. At any rate, however, the intervention leads to (1) collapse of cavernous lung tissue; (2) extensive exclusion of the lung on the operated side from the respiratory function; (3) retardation of the pulmonary circulation in this lung; (4) through the arrest of breathing in this lung, an essential diminution of the lymphatic circulation and absorption.

The natural results of the interference are, in the first place, a considerable taxation of the opposite lung for the respiratory function. Very promptly a compensatory increase of volume is developed in this lung,—as I am enabled to demonstate to you in the series of pictures which I present (Fig. 6).

Whether this immediate increase in volume of the other lung develops in the further course into a compensatory emphysema, or whether the increased functional activity is followed by genuine hypertrophy of lung tissue—as in other paired organs of the body—cannot yet be positively determined, as none of the operated patients have died at the end of a long time, so that the question could be settled on the autopsy table. Here again our current experimental work enters into consideration. At any rate, the problem is of great theoretical and practical interest, and it requires very careful investigation.

It cannot as yet be considered as definitely settled, and there are sure to be certain differences in the course taken by individual cases, in how far tuberculous foci of the side not operated upon will undergo a more rapid evolution, or be affected in a favorable way. In several cases, slight aggravations were noted immediately after the operation, but we never had a regrettable acceleration of the general course, or a death; on the contrary, we became convinced that in the majority of the cases the foci on the opposite side are favorably influenced. An unconditional preliminary requirement for admission to the operation is to select *only such cases of unilateral phthisis in which the other side is not simultaneously affected with active progressive foci, passive* processes alone being present. In the further course, it may prove harmful, as was noted in two of our cases, that the de-ossified chest wall remains permanently boneless. In the first of our cases, we considered it as an object of the operation to ablate the retrocostal periosteum as completely as possible, and to make the pleura yield. Through the above experience, we have been led to *leave the retrocostal periosteum behind,* at present. It is then in our power to render the shrinkage of the lung very thorough within a few months, under simultaneous light pressure upon the operated side. After this period of shrinkage, the re-establishment of periosteal ossification is desirable, in order to counteract the bulging out of a still inflatable portion of lung in the act of coughing. A case among our latest observations, in which this regeneration has occurred in all of the ribs, belongs to the most favorable results of our treatment.

I have recently gone a step further, in the mobilizing and loosening of the lung tissue, by detaching separately in the course of the operation the pulmonary *apex,* together with the overlying costal pleura from the entire surroundings, or by removing the first rib also, thereby rendering the apex of the lung more shrinkable. As showing the shrinkage of the lung in our recent patients taking place in the course of several months, I will mention particularly two cases. In one we had to deal with a rapidly progressive and at the same time infiltrating tuberculosis; and in the other a badly weakened, desperately ill patient, with extremely severe, highly febrile right-sided phthisis. I adhered to my mode of incision in all the total pleuropneumolyses, limiting myself only in the case of female patients to a predominantly posterior incision with full preservation of the breast. In my last cases, I detached the apex of the lung by itself and endeavored to induce its shrinkage. The radiographs show how markedly the first rib gradually descends in our operated cases, becoming displaced mesially, and together with the soft parts of the shoulder, the clavicle and the scapula, furthers the restriction in volume of the pulmonary apex. In my most radical procedure of de-ossification of the chest-wall, the first rib had always been preserved, in consideration of the fact that its removal adds considerably to the length of the operation, increases the technical difficulties, and thus heightens the risk run by the patient. Blunt subcostal detachment, on the other hand, may be carried out quickly, easily and without damage (apicolysis). The total structure of the lung apex is thus rendered still more susceptible to shrinkage. My original intention in these two cases (October and December, 1908), was to remove the first rib also; but the difficulty of enucleating the rib induced me to adopt the conservative procedure of *subcostal apicolysis.* In the absence of old periosteal inflammations of the ribs, as a sequel to *apicopleuritis,* as existant in the above two cases, the ablation of the first rib is not, however, attended with special difficulties. The first skin-muscle-flap incision should be *carried up higher in the posterior circumference,* and the plastic flap be pushed gently away until beyond the first rib; the subclavian artery and vein are suspended in the flap; the anterior and posterior scaleni are transversely divided with the knife at their costal insertion, or detached by blunt dissection. The insertion of the scaleni may be very firm; they do not necessarily follow the periosteum as it is levered off. The first rib can now be raised with my rounded elevator, and removed like any other rib. It goes without saying, that the ablation of the first rib induces the most thorough shrinkage of the pulmonary apex. In a case which was recently operated upon, I removed the first rib also.

Several cases have caused me to try circumscribed costal ablations when the lesion concerned exclusively the lower lobe or the upper lobe, and was apparently circumscribed. In a general way, however, I wish to summarize the result of these operations, to the effect that it will always prove advisable to *extend the scope of the operation considerably beyond what seems to be required by the extent of the lesion.* The reason for this is, that the collapse of the lung takes place to a relatively slight extent only when the number of the ablated ribs is not considerable, and the individual ribs have not been completely removed. The continuity of the costal pleura prevents the lung from sinking in as far as desired.

As has been pointed out in my last publications, the cases should be *strictly selected,* and *only* those patients operated upon who have *unilateral* cavernous lesions, with at most *passive* foci on the opposite side. They must be free from evident recent tuberculous processes in other regions of the body, more particularly the bowel.

STATISTIC TABLE.—A. UNILATERAL LUNG PHTHISIS. TOTAL PLEUROPNEUMOLYSIS. (II–X RIB.)

Case No.	Sex	Age	Position
1	Man	28	Left side *
2	Man	18	Left side *
3	Woman	32	Right side *
4	Man	31	Right side *
6	Woman	30	Left side ‡
8	Man	16	Right side *
10	Man	21	Left side (also apicolysis) †
11	Man	23	Right side (also apicolysis) *

B. MULTIPLE TUBERCULOSIS OF THE BODY. I. TOTAL THORACOPLASTIC PLEUROPNEUMOLYSIS.

Case No.	Sex	Age	Position
7	Man	17	Left side (also progredient intestinal tuberculosis and nephritis). Death, 5th day.
14	Man	34	Right side (also extensive suppurative costal tuberculosis) ‡
13	Man	19	Left side (also laryngotuberculosis, removal of the 1st rib). Death, 3d day.

II. PARTIAL PLEUROPNEUMOLYSIS; PARTIAL REMOVAL OF THE RIBS.

Case No.	Sex	Age	Position
5	Man	35	Left side, also right recent cavernous phthisis and larynx phthisis. Death, 4th day.
9	Man	47	Right side, also progredient suppurative costal tuberculosis. Death, 2nd day.
12	Man	40	Right side, and circumscribed cerebral tubercle.†

Certain recent cases have encouraged me to extend the procedure also to conditions of *slowly infiltrating non-cavernous phthisis,* since Case 8 showed, that the arrest of respiration is in itself capable of creating relatively favorable conditions for the cure of this type of phthisis also. These statements are made cautiously and guardedly, however.

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* = Good, or best, recovery.
† = No better than before the operation.
‡ = State not so good as before the operation.

The direct mechanical effect upon the heart, through the collapse of the diseased lung, may constitute a serious feature of the operation, as I have shown in former publications. It does not manifest itself, however, in the presence of conditions such as those pointed out above, when the lung which is to be constricted is already very rich in connective tissue, and when the formation of pleural and mediastinal adhesions guarantees a certain stability of the topical relations in the interior of the thorax. I have furthermore succeeded in guarding against the danger of acute dislocation of the heart, by a simple device, namely, raising the arm of the affected side above the horizontal plane and still keeping the lung of the operated side somewhat in the balance, as it were, through the traction of the scapula and muscles, so that the effect upon the heart is allowed to manifest itself only gradually. The sum total of our experiences is that we have not lost a single patient through this cardiac disturbance.

In so far as the circulatory stasis in the blood and lymph currents of the lung on the operated side may mean a direct advantage for the local cure of the tuberculosis and for the restriction of its further spread, this must be left an open question for the time being.

In four of our cases, a slight scoliosis of the vertebral column has developed, with the convexity towards the side of the operation (Fig. 3). The absence of the ribs as points of leverage for the shrinking, accounts for this form of the scoliosis. It is not marked enough in any case, not to be readily accepted by the patients in view of their otherwise improved condition.

The function of the serratus, elevation and other motions of the arm are very completely re-established after the operation, sometimes after having been impaired during several months. Only recently I had the opportunity of re-examining three male patients who had been operated upon on the right side, and had not sustained the slightest loss of strength in the right arm and right shoulder. I exhibit the pictures of one of these patients, with extensive right-sided cavernous phthisis,

Fig. 2.

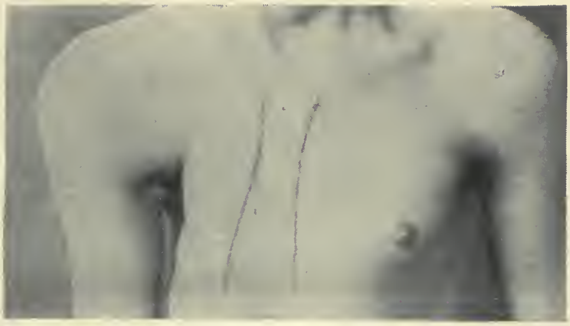


Fig. 3.

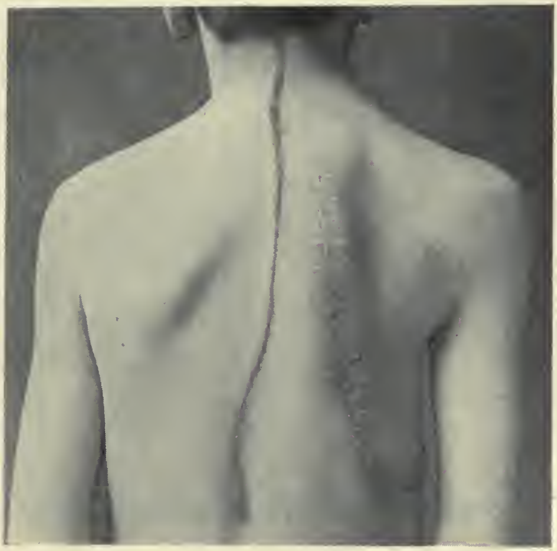
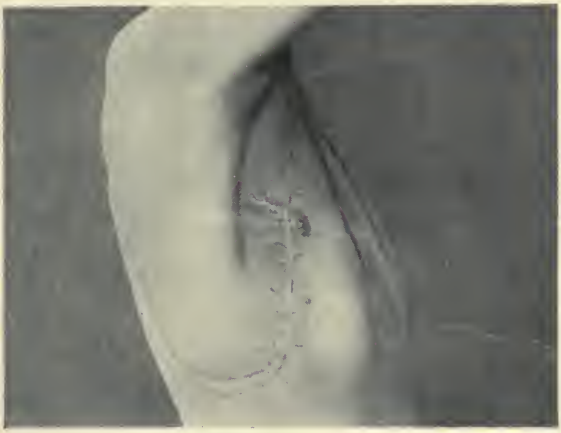
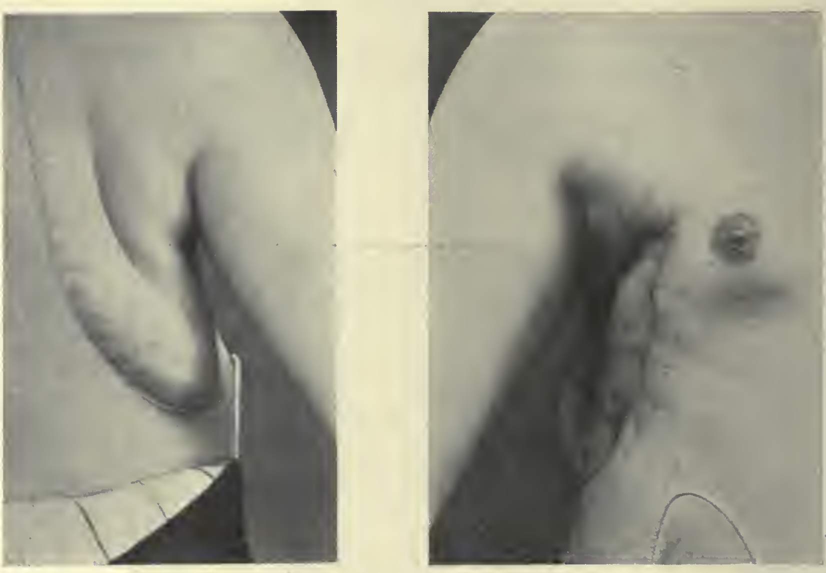


Fig. 4.



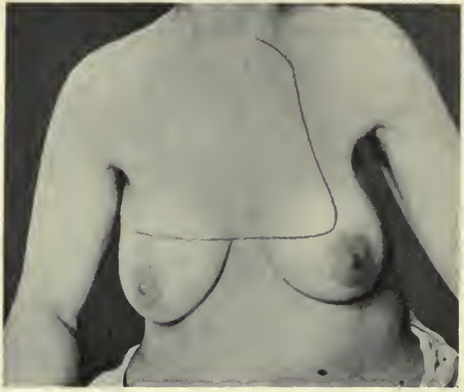
Phthisis, right lung. Total pleuropneumolysis. Best recovery. Dislocation of the sternum and vertebral column.

Fig. 5.



Case IV.—Extensive cavernous right-sided phthisis. Total pleuropneumolysis. Two and a half months, and one year after.

Fig. 6.



Case VI.—Diagram showing compensatory increase of volume developed in opposite lung.

photographed two and a half months and one year after the operation (Fig. 5).

The essential results of this treatment have already been published in German periodicals, and I am now in the fortunate position to state that we were again and again enabled to note a confirmation of our first experiences. The immediate results in the course of the disease are usually particularly impressive; *defervescence* follows rapidly, as a rule in patients with a high fever. The subsidence of the fever must be a result of the changed conditions of absorption, and accordingly permits a conclusion as to the favorable influence upon the latter, that becoming an *objective graduator* for the immediate effect of the operation.

In every case the amount of sputum is reduced enormously (from 200 to 10 cm. and less) within some days, at most weeks, after the operation, and the irritative cough diminishes. This would seem to justify the conclusion that it is the collapse of the cavities, after the relaxation of the lung tissue, and the cleansing of the cavity wall, which induces this result. This is the most impressive feature for the patient to begin with. Our past experience further shows, however, that not only the cavernous tissue is favorably influenced by *putting the lung at rest,* but so also to a considerable extent, is the as yet non-disintegrated, infiltrated portions. This is rendered intelligible in view of the encapsulation and cure of tuberculous foci, frequently observed elsewhere after the fixation of organs affected with tuberculosis. The potential conditions for curability are certainly more favorable in the lungs than in most other organs with the tuberculous affections of which we are concerned. Our verdict in this respect must necessarily be guarded, in view of the lack of post-mortem evidence. Should this observation be further confirmed, it would materially extend the indications for our intervention.

In all our cases, an increase of the body weight and improved subjective condition are noted in the further course. It remains of the greatest importance to see to it that in the selection of the cases for the operation, the patient has not yet passed his fortieth year, that the general nutrition either is fairly good or is rendered as favorable as may be prior to the performance of the operation, by means of climatic treatment, rest in bed, and dietetic measures. It is also necessary to ascertain that aside from the diseased lung of one side, there are *no recent* tuberculous manifestations in other organs. I should certainly be extremely cautious in the admission of such cases, and have only had reason for regret whenever I have allowed myself to be persuaded to operate on the request of patients who had been dazzled by our results in other cases. Three such patients, with multiple tuberculosis (also of the larynx, bones or bowel), died in immediate connection with the operation.

Concerning the extent of the affection on the diseased side, however, we have no restriction to offer at present, simply repeating that the more complete a restriction in volume can be obtained, the more complete will be its beneficial effect. Our cases without exception concerned very far advanced consumptives, in all of whom the prognosis of persistent aggravation had been rendered by highly competent physicians. Hence, he who interferes with a grave condition such as this by means of such a radical operation, will keep in mind that the measure of success cannot be guaranteed, and is necessarily relative only. But even if surgical interference improves the situation in so far only as to lengthen the lives of a certain percentage of otherwise doomed consumptives, giving them a sensation of returning health, and introducing more or less positive objective amelioration of the general condition and the local lesion, this means a step in advance which physicians and patients will hardly fail to appreciate.

RESECTION OF RIBS, COMBINED WITH EXTERNAL PRESSURE, IN THE TREATMENT OF TUBERCULOSIS OF THE APEX OF THE LUNG.*

BY LEONARD FREEMAN, M.D.,

OF DENVER, COLO.,

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ALTHOUGH so much has been done towards the successful management of pulmonary tuberculosis, through climate and hygiene, the possibilities of surgery should not be lost sight of, especially in cases which resist ordinary methods of treatment. Enthusiasm in this direction, however, should be tempered with reason and caution, bearing in mind that many obstinate cases recover spontaneously. No operation should therefore be considered that does not offer at least a fair likelihood of substantial improvement, without too much danger, and without too great a prospect of leaving the patient worse than before, although it must be admitted that desperate measures may occasionally be advisable in desperate cases. From this point of view, such operations as pneumonectomy, pneumonotomy, and Friedrich's "costoplastic pneumolysis" should be approached with caution.

One of the most potent factors in the cure of pulmonary tuberculosis, with or without the presence of cavities, is the gradual formation and contraction of fibrous tissue, which seems to be promoted by collapse of the lung and freedom from motion. Hence any procedure favoring pulmonary retraction, as a whole or in part, should be of service. A spontaneous tendency in this direction exists in the subclavicular flatness, intercostal hollowing, and drooping of the shoulders, so often observed in consumptives; and it is suggestive that athletic individuals with well developed and powerful thoraces often exhibit the most rapid and hopeless forms of phthisis.

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* Read before the American Surgical Association, June 3, 1909.

Pulmonary collapse may be obtained, to a greater or less extent, in several ways: (1) By the production of an artificial pneumothorax (Murphy, Forlanini). (2) By extrapleural resection of nearly all of the ribs below the first, from their cartilages to the spine, and including their periosteum (Friedrich). (3) By the removal of portions of some of the ribs, with their periosteum, along the axillary line (Quincke, Spengler, Turban, Landerer, Garré, etc.). (4) By the resection of portions of several ribs and their periosteum directly over the diseased part of the lung, usually a cavity near the apex. (5) By a similar operation, without the removal of the periosteum, followed by external pressure by means of a truss, this being the procedure to which I desire to call attention in this paper.

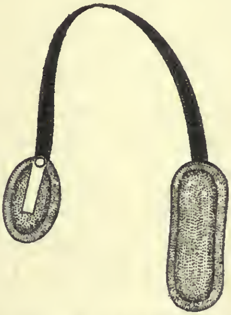
The Murphy-Forlanini method is quite free from danger and is of undoubted value when the lung is free; but when adhesions are present its feasibility and usefulness are correspondingly lessened. In disease of the apex, especially if advanced and with a tendency to the formation of cavities, the procedure is restricted in its usefulness, because of adhesions which prevent collapse and cause continuous movements in unison with those of the thoracic wall. This does not necessarily mean, however, that nothing is gained, because tuberculosis of other portions of the lung may be benefited; but it does mean that the chest-wall directly over the diseased apex must be mobilized if the best results are to be obtained.

Friedrich's costoplastic pneumolysis is an extensive operation and by no means free from danger, especially in the advanced cases where it is most strongly indicated, requiring, as it does, the complete removal of nearly all the ribs, together with their periosteum. The technic is difficult, because the delicate pleura must not be torn; and the work must be rapidly done owing to the weakened condition and defective circulation and respiration of the patient. Manifestly the method is only justifiable in extensive lesions, where adhesions exclude the production of an artificial pneumothorax, and where all ordinary treatment has failed.

The removal of portions of ribs and their periosteum along the axillary line varies in danger and difficulty according to the extent of the operation. Its effectiveness will depend largely on the nature and situation of the adhesions and the areas of lung involved. An adherent apex, for instance, could not be greatly influenced by the removal of a few ribs along the side of the chest.

A limited resection, however, of two or three ribs near the apex can be done with perfect safety, under local anæsthesia if desirable, and may be of much service, especially if supplemented by external pressure in the manner to be described. The chest wall can in this way be caved in directly over the seat of the disease, where most needed, thus favoring shrinkage of cavities and healing by fibrous contraction. In spite of contrary statements I am convinced that much good cannot be obtained in such cases by costal resection elsewhere, or by the production of an artificial pneumothorax, owing to the resistance to collapse presented by the thickened lung tissue reinforced by a rigid, adherent thorax.

Fig. 1.

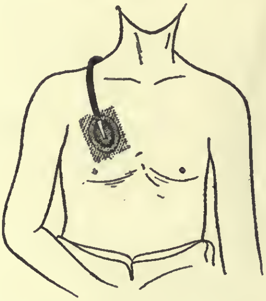


Truss for external pressure on wall of thorax after resection.

This procedure should not be applied indiscriminately, but should be reserved for refractory cases with marked and limited apical lesions, especially when a tendency to the formation of cavities exists. It should also be of service as an adjunct to an artificial pneumothorax, when there is reason to believe that the trouble in the apex is of such a character that it will be but little influenced by collapse of the remainder of the lung.

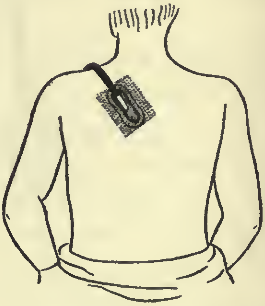
In this operation two or three inches are removed from the second, third, and possibly fourth ribs, below the clavicle; and if it seems to be desirable, the cartilage of the first rib may also be divided in the manner suggested by Freund. This much has been done now and then with varying results for many years, for instance by Macewen, of Glasgow. Occasionally the periosteum was removed, and often it was allowed to remain, but as far as I have been able to ascertain, external pressure was never employed.

Fig. 2.



Thoracic truss applied, anterior view.

Fig. 3.



Truss applied, posterior view.

When the periosteum is *not* removed the ribs usually reform quite rapidly; hence, seeing that retraction and healing are slow processes extending over months at least, the utility of the operation is necessarily limited unless collapse is hastened by external pressure. Even when the periosteum *is* removed, at the expense of increased operative risk, the thickened and sometimes almost cartilaginous pleura must retard the cure.

It occurred to me some years ago that collapse of the thoracic wall might be materially hastened and increased by the application of external pressure by means of a truss. In order to accomplish this the second and third ribs are resected through a flap-incision, and after the wound has healed and lost its sensitiveness, a bunch of gauze is placed over the part and an ordinary spring-truss adjusted so as to make considerable pressure, the pad of the truss resting in front and the spring passing over the shoulder to the back, where it obtains its counter-pressure. An ordinary truss with a good spring and an adjustable pad will answer the purpose, although it may be advisable to shorten the spring and add a large flat pad to fit the back. The pressure can be increased to the point of tolerance, either by increasing the thickness of the gauze pad or by altering the curve of the spring. The apparatus need not be uncomfortable when properly adjusted.

It is surprising how quickly and decidedly the chest wall can be caved in by this simple and safe procedure, leaving a saucer-like cavity, in spite of the fact that the periosteum of the ribs has not been removed; in fact the preservation of the periosteum may be of some service, in that the re-formation of bone may help to retain the full depth of the depression. Another service which the truss renders is to assist, by its constant firm pressure, in the local immobilization of the thorax, thus placing the lung more nearly at rest.

Recovery from a tuberculous lesion is necessarily slow, especially if a cavity is present, and may be protracted over many months, even under the most favorable conditions; hence marked improvement should not be looked for too soon. And it must also be understood that an operation is but a factor in the cure and perhaps not even the most important one.

I have employed this operation in but two instances, but in both the results were encouraging. The case-histories are briefly as follows:

Case I.—A young man of nineteen, an inmate of The Denver National Jewish Hospital for Consumptives, who had been afflicted with hemorrhagic phthisis for about four years. Quite a large cavity existed in the left lung just below the clavicle, from which several ounces of yellowish, nummular sputum were expectorated daily. He was weakened and emaciated and there was no tendency towards improvement. Portions of the second and third ribs were removed, truss-pressure applied, and a marked depression rapidly produced. Decided improvement was noticed in about five months. At the end of twelve months the nummular sputum had practically disappeared and has not returned up to the present time—about eight years. The general health has also undergone marked improvement, although he is still tuberculous. It is worthy to note that some months previous to the above intervention a spontaneous pneumothorax had occurred, followed by an empyema, for which an extensive Estlander operation was done. Although perhaps two-thirds of the lung had thus been collapsed, no curative effect upon the cavity resulted until the chest was caved in at the apex.

Case II.—A man of 45, who had had phthisis for twenty-five years (patient of Dr. Alfred Mann, of Denver). A large cavity existed at the right apex, reaching down to the third rib, from which a characteristic expectoration of several ounces took place during the twenty-four hours. About three inches of the second and third ribs were removed and truss-pressure applied, which caused a rapid sinking in of the chest wall. In about five months a decided improvement had taken place, the nummular sputum being reduced to a small quantity. There has been no re-formation of the cavity at the end of 7 years and the general condition of the patient remains much improved, although there are still evidences of the presence of moderate pulmonary tuberculosis.

Conclusions.—1. The healing of stubborn tuberculous pulmonary lesions is favored by collapse of the lung.

2. This may be obtained by (*a*) artificial pneumothorax; (*b*) extensive extrapleural resections of all of the ribs, with removal of their periosteum; (*c*) local resections of ribs, especially at the apex.

3. The first method is not always applicable, owing to adhesions and to induration of lung tissue, while the second is difficult and dangerous, and should be employed under exceptional conditions only.

4. The third method is applicable to obstinate troubles at the apex, and can be employed alone or in conjunction with an artificial pneumothorax, according to circumstances. Its full benefit cannot be obtained, however, unless the removal of the ribs, which need not include their periosteum, is followed by the application of firm external pressure in the manner suggested by the writer.

THE TREATMENT OF FISTULÆ AND ABSCESSES FOLLOWING OPERATIONS FOR EMPYEMA OF THE THORAX.*

BY ALBERT J. OCHSNER, M.D.,

OF CHICAGO,

Surgeon-in-Chief of Augustana and Saint Mary's Hospitals.

Although the relative proportion of persistent fistulæ and abscesses is not so great as formerly after operations for the relief of empyema of the chest, since surgeons take the same precautions as in aseptic cases to prevent secondary infection during and after this operation, they are still sufficiently common to be a source of much annoyance to the surgeon.

There are, of course, other elements of value from the standpoint of prophylaxis, aside from that of aseptic operation and after-treatment.

The method advised by Murphy of aspiration and subsequent injection into the pleural cavity of 60 c.c. of a 2 per cent. solution of formalin in glycerine and the plan of making tubular through drainage in case of operation instead of simply making drainage into the pleural cavity, should be mentioned especially. The former method of treatment makes the latter unnecessary in many cases, and the latter method reduces the number of persistent fistulæ and abscesses to a minimum, because it eliminates the formation of pockets.

In cases in which these sinuses or abscesses persist, however, in which formerly the method of Estlander and Schede gave the most reasonable promise of ultimate success, surgical treatment has often been most disappointing. It is just in this class of cases that the method introduced by Dr. Emil Beck has given the most satisfactory results.

The method consists in filling the sinus or pus cavity with one or two solutions of bismuth subnitrate and keeping this in position by plugging the outer opening with gauze. Solution No. 1 consists of one part of arsenic-free subnitrate of bismuth and two parts of sterile amber vaseline; solution No. 2 contains 30 parts of bismuth, 60 parts of amber vaseline, and ten parts of paraffine of sufficient hardness to give the mass a fair degree of firmness at the body temperature.

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* Read before the American Surgical Association, Philadelphia, June 5, 1909.

No. 1 is injected every second day until suppuration has almost disappeared, then No. 2 is injected in its place. The injections are repeated as often as necessary to keep the sinus or pus cavity constantly filled with the mixture. At first it is necessary to do this every day or every second day, then every third and so on until it may be necessary to inject not oftener than once a week or ten days.

The Table on pages 154, 155 and 156 gives a list of fourteen cases in which we have employed this form of treatment, and it shows results which are much better than those we were able to obtain previously.

One feature has been most striking. In cases which were in a septic condition when the treatment was commenced, the improvement of the general condition of the patient was especially marked. Pulse and temperature became normal within a few days and the general appearance of the patient lost the characteristics of sepsis. The nutrition improved and the anæmia disappeared rapidly. The discharge from the sinuses usually becomes sterile in a short time.

To illustrate this a short abstract of the history of Case V will be typical.

A. S., an Italian laborer, 60 years of age, had a pneumonia followed by empyema of the right thorax, seven months ago. The pleural cavity was drained; a sinus persisted, leading into a large cavity. Three months later Estlander's operation was performed with excision of three ribs. The patient was in a severely septic and anæmic condition when he entered the hospital October 5, 1908. An injection of 720 c.c. of mixture No. 1 was given and the patient put to bed. In two days 60 c.c. more was injected, but by this time the septic condition had markedly decreased, and within a week the patient became normal and his anæmia began to disappear. For one month injections were made every second day, the quantity in the meantime decreasing to 35 c.c. and the patient acquired a rosy appearance. Then he was sent home,—at first, to return twice a week to have a few c.c. of No. 2 injected, and later only once a week, a sufficient amount being used each time to fill but not to distend the cavity.

At present, June 1, his general health is perfect and there is but a superficial sinus which holds scarcely 5 c.c. of the paste, and which will undoubtedly heal completely in a short time.

A second case, No. 3, seems worthy of special description because it is one of the cases that were formerly extremely difficult to heal.

History in Abstract.—F. C., American, age 35, miner, had a severe fall nine months ago while working in the mountains; this was followed by pneumonia and then by a right sided empyema. This was drained through a rib resection opening. Seven months later an Estlander operation was made, with resection of three ribs. At the end of two months the patient came under our care—November 24, 1907. At this time there was a sinus discharging pus freely, and the patient coughed up the same material. This was before we were familiar with the bismuth paste treatment—so we performed Schade's operation. The patient did well for nearly a week, when he developd a phlebitis in both femoral veins. He became markedly septic and emaciated. Four weeks later he still expectorated pus, and there was a free drainage of pus from the wound when we began the injection of No. 1 bismuth paste. He expectorated much of the 650 c.c. of the paste we injected. We repeated the injection, each time simply filling the cavity without using any force. The pus and the sepsis subsided rapidly. In ten days he appeared like a different person, and in twelve weeks he was perfectly well.

I have used this method in fourteen cases at the Augustana Hospital in the treatment of sinuses or abscesses which have persisted after operation for the relief of empyema of the chest. Three of these cases had been operated twice and one three times before this method was employed, without obtaining a cure. Of the fourteen cases all but two, which are still

SYNOPSIS OF CASES OF THORACIC FISTULÆ TREATED BY BISMUTH PASTE INJECTIONS

Number	Hospital number	Sex	Age	Admitted	Discharged	Date of primary operation	Date of second operation	Injection of bismuth paste	History	Result
1	19986	F	11	Dec. 27, 06	June 27, 07	Dec. 29, 06	....	Had 12 injections of paste every 3rd day 1 to 3 ounces beginning Jan. 21, 1908	At time of operation, Dec. 29, 1906, 500 c.c. of pus evacuated. Empyema followed attack of measles. Through and through drain was placed. Sinus persisted two years when injections were used	Sinus closed completely after 12 injections.
2	21933	F	69	Oct. 10, 07	Feb. 17, 08	Oct. 12, 07	....	Injected with paste every 3–4 days from March 19, 1908 to February 22, 1909. 1–4 ounces	Empyema followed attack of pleurisy of 3 months duration. Three ribs resected but sinus persisted and patient returned 1 year later for injections	After 24 injections practically closed and patient returned home.
3	22220	M	25	Nov. 24, 07	Mar. 29, 07	Mar. 14, 07	Oct. 4, 07 Nov. 24, 07	Injections began December 20, 1907. First injection 20 ounces; second injection 12 ounces. After this varied from 2 to 8 ounces	Empyema followed pneumonia. Resected portion of 3 ribs. 7 months later had profuse discharge of pus and 6 weeks later greater portion of 6th, 7th, 8th and 9th ribs were removed. Patient still remained septic	Patient showed marked improvement after first injection, making rapid recovery. At end of 3 months wound perfectly healed; 38 injections given.
4	23120	F	16	Apr. 15, 08	June 13, 08	Apr. 16, 08	....	Injections began June 25, ended August 8; amount from 1 to 4 ounces; intervals 2 to 6 days	Empyema of chest following la grippe. Portion of 8th rib resected and about 30 ounces pus evacuated. Through and through rubber drains. Patient left hospital June 13, 1908; drainage remained rather profuse. On June 25 returned to hospital for bismuth treatment	Patient gained rapidly from time of first injection, and August 10, 1908 wound was completely healed. About 15 injections were given.

5	24315	M	60	Oct. 5, 08	Oct. 22, 08	Mar., 08	July, 08	Injections began October 5, 1908. 12 ounces injected daily for 5 days. After this 1 to 3 ounces every 4th or 5th day	Empyema of chest following pneumonia. Both operations done elsewhere. On admission to hospital 4 months after second operation, had profuse discharge of pus from chest	Made satisfactory progress. At end of 6 weeks was practically no discharge of pus. Sinus almost closed. Holds only 5 c.c.
6	24497	M	28	Oct. 28, 08	Mar. 4, 09	Oct. 29, 08	....	Injections began November 10, 1908. Quantity 2 to 12 ounces, interval 2 to 6 days	Empyema of right chest, following stab wound on September 20, 1908. On admission patient was in a septic and greatly emaciated condition. Portion of rib (6th) resected and drainage established	Patient gained rapidly after beginning of injections. Is back to normal weight. Sinus not completely closed June 1, 1909.
7	24674	M	18	Nov. 23, 08	Feb. 10, 09	June 28, 09	Nov. 24, 08	Injections from December 12, 1908, to February 10, 1909. 1 to 2 ounces every second or third day	Empyema following pneumonia. Rib resected June, 1907. Profuse discharge of pus until admission November 24, 1908. 3 ribs resected and through and through drainage placed	Patient made satisfactory recovery and sinus was closed at time of discharge from hospital, after 25 injections.
8	24694	F	20	Nov. 25, 08	Dec. 27, 08	Nov. 25, 08	....	Injections began December 25, 1908 and continued to February 4, 1909, at intervals from 2 to 6 days. Amount, 1 to 4 ounces	Empyema following pneumonia. Resection of 7th rib on right side and large amount of pus evacuated. Through and through drainage placed	Patient made very satisfactory progress, with complete recovery at end of 12 weeks.
9	24717	M	41	Nov. 29, 08	Dec. 24, 08	Nov. 29, 08	....	Injections 1 to 2 ounces every second day from December 5, 1908, to December 23, 1908	Empyema of right chest. Right 9th rib was resected and 25 c.c. pus evacuated. Colon bacillus and streptococcus	Patient gained rapidly and left hospital 25 days after operation. Sinus in chest still open. Has healed entirely June 1, 1909.
10	25024	M	18	Jan. 19, 09	Mar. 19, 09	Jan. 20, 09	....	Injection from February 19 till March 19, 1909, at intervals from 1 to 3 days	Empyema following pneumonia. Resected part of 7th rib, left side. Evacuated about 40 ounces of pus. Drainage placed	Made very rapid recovery. Small sinus present at time of discharge from hospital, but no discharge of pus. Entirely healed June 1, 1909.

SYNOPSIS OF CASES OF THORACIC FISTULÆ TREATED BY BISMUTH PASTE INJECTIONS—*Continued*

Number	Hospital number	Sex	Age	Admitted	Discharged	Date of primary operation	Date of second operation	Injection of bismuth paste	History	Result
11	25117	F	8	Feb. 1, 09	Apr. 5, 09	Feb. 3, 09	....	Injections began February 20, 1909, at intervals 1 to 3 days. Amount 1 to 3 ounces	Empyema following pneumonia. Resection of 4th and 5th rib. Evacuated 12 ounces of pus. Drainage placed	Complete recovery at end of 9 weeks.
12	25195	M	45	Feb. 12, 09	Still in hospital	May 19, 08	Feb. 15, 09 Apr. 2, 09	Injections begun February 20, 1909. Continued at intervals 1 to 3 days since	Tuberculosis of 4th rib. May, 1908, a sinus was curetted. February 15, 1909, excision of 4th and 5th ribs. Tuberculous. April 2, 1909, 4th, 5th, 6th, 7th and 8th ribs left side were resected and about 16 ounces of pus found in pleural cavity. Cavity drained and later injected with bismuth paste	Patient greatly improved; still in hospital. Present discharge slight.
13	25212	F	4	Feb. 16, 09	Apr. 7, 09	Feb. 18, 09	....	Injections began March 1, 1909. 2 to 4 ounces every day for 4 weeks	Empyema following pneumonia. Resection of right 7th rib and evacuation of 12 ounces of pus	Complete recovery at end of six weeks.
14	25816	M	24	May 10, 09	Still in hospital	July, 05	Aug., 05 June, 07	Injections began on admission. 6 to 8 ounces injected 3 times a week since	Empyema following pneumonia. In July, 1904, after 3 operations, sinus still persists with profuse discharge of pus. At last operation 4 ribs were resected	Patient gaining in weight. Pus discharge greatly diminished.

under treatment, have been cured, and these two are making satisfactory progress.

This treatment has proven most satisfactory in our practice. We have used it only in cases with sinuses, although it has been suggested to aspirate the pus in empyema and to inject the paste into the pleural cavity through the trocar.

There has been no case of bismuth poisoning in our series of cases, although this might easily occur—as it has when cavities in other portions of the body have been filled with large quantities of bismuth paste. If this occurs, Beck advises the immediate injection of hot olive oil, 110° F., which will dissolve the paste and facilitate its escape through the outer fistula or through a drainage tube, which may be inserted.

The injection is made with a large, ordinary glass syringe, just enough force being employed to fill the sinus or cavity, but not enough to cause forcible distention. The outer opening is carefully plugged with sterile gauze.

EMPYEMA THORACIS.*

BY ALBERT VANDER VEER, M.D.,

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It is safe to assert there are few lesions where the physician and surgeon are called upon to assist each other in diagnosis and treatment, more interesting, and, at times, more difficult, than effusions within the pleura. Plastic pleurisy may have its surgical complications, but it is largely a medical condition, and one wherein the surgeon is not so much concerned. The serous effusions, however, present an entirely different history and line of procedure. Few conditions give so entertaining a solution of questions that, seemingly, forty-five years ago, were so hidden and mysterious, studied at that period, and even for two decades later, with the firm belief that surgical intervention was too dangerous to undertake. As one recalls these early impressions one cannot but feel encouraged over the fact that in this line of investigation operative surgery has made advances commensurate with the pathology and technic of other important branches of our art. It is not my province to discuss why a serous effusion in one case—where one-fourth, one-half or even more of one side of the chest may be involved—may continue for months, or even years, without any evidence of pus being present, and yet another case with the same clinical history may in a few weeks or months terminate in pus and present the condition we term empyema.

The only argument I have to offer in presenting this paper is my personal, practical experience. The point I wish to bring out is the change, in my time and in the memory of many members of our profession here to-day, in the surgical treatment of these cases. The willingness with which the general practitioner encourages the surgeon to approach these cases to-day, compared with four, three or even two decades ago, is comparable only to the advance that has been made in the treatment of lesions of the appendix, the gall-bladder and other organs within the abdomen; yet it cannot be said that this change is entirely due to the aseptic surgery that has permitted us to invade the peritoneal cavity so boldly, for the technic of the two operations is very different. My early recollection of surgery of the chest presents a strong contrast with what we are now doing so fearlessly. Then, when once it was determined to evacuate fluid from the pleural sac (almost invariably pus) what precautions were demanded! We had had it impressed upon us by such splendid men as Trousseau and others, as early as 1846, and again in 1864, that the operation for paracentesis was an exceedingly grave one, and should be had recourse to only " when there is danger to life from immediate suffocation, or when the effusion is very large." Marrote, writing at the same time, gives a clear distinction between serofibrinous and purulent effusions and states, " that the radical operation of incision is the only one in purulent effusions that is at all likely to lead to a cure," and he was right, yet how very slow were our surgeons in following this advice. How well do I call to mind the discussions in our societies on up to 1880, as to the manner of treating effusions within the chest, in reference to evacuation and the entrance of air. In my early years of practice I had read Bowditch's discussion of the subject, presented as early as 1852, in which he advocated aspiration, and its application to all thoracic effusions; later another paper, published by him in the *American Journal of the Medical Sciences,* in 1864, in which he denies " that any ill results are likely to follow, or that purulent effusions cannot be effectually withdrawn through the capillary tubes provided for that operation." These were convincing contributions, yet how many suggestions were made at this time controverting his views! One very ingenious method was that of fastening about the cannula a portion of rubber tubing, or rubber dam, in such a manner that a trocar could be introduced and withdrawn under water, and the operation performed in such a way as to exclude the entrance of air into the chest cavity. This was a method that was advocated with a good deal of earnestness. My study of Bowditch's papers, and the experience I had had during the Civil War, led me to believe that these cases required free drainage, and that this fear on the part of the physician, and his unwillingness to yield to the advances of the surgeon's experience, would pass away; yet how slow was the progress. The method of simple aspiration carried with it such a high mortality that aseptic surgery was hailed as a factor of great assistance, and incision was encouraged, but only with the employment of the strong carbolized spray. I have often seen this used, and compelled myself to make use of it, because of the pressure brought to bear by the attending physician, who wanted Listerism carried out to the utmost, and yet how clearly would nature demonstrate her ability to take care of the chest cavity if only a free opening were provided! In 1864, Dr. Howard, of the United States Army, was permitted to go to the front to treat gunshot wounds of the lung by immediately sealing the wounds of entrance and exit with collodion, then applying firm compresses over the chest, the object being to exclude the air. I had an opportunity of witnessing this procedure in several cases, and in every instance if the effusion of blood did not force the dressing the accumulation of pus would be such that the dressings would become saturated and nature would assert her desire for free drainage. At that time I considered thoughtfully the *few* remarkable cases, such as that of General Shields during the Mexican, and others, in which it was said a silk handkerchief was passed through from one opening to the other, recovery following, and it seemed to me that Dr. Howard's method would soon be counted a failure, which it was within a very short period. However, I did not make use of my impressions afterward, in civil practice, for the opinion of the general practitioner with whom I came in contact was opposed to any such procedure as a free opening into the chest, but Dr. Bowditch's views were gaining ground and were bound to prevail.

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* Read before the American Surgical Association, June 4, 1909.

Among the number of gunshot wounds of the chest and perforation of the lung treated successfully by myself during the Civil War, the following is most typical:

Lieut. A. N., 66th N. Y. Vols., æt. 21 years, July 21, 1865, while with his company, in trying to control a riot, was struck by a Minie ball, which entered the cavity of the thorax between the sternal end of the left clavicle and the second rib, without fracturing either. The wound was received while advancing towards the person firing, who was not more than fifteen feet distant. This bullet passed directly through the apex of the lung, making its exit just above the spine of the scapula, fracturing the latter bone severely. He was wounded at six P.M. and I saw him about a half hour later. The patient was bleeding very freely, expectorating blood, respiration extremely difficult, pulse rapid and hard to count; pupils largely dilated; suffering much pain. I immediately gave him ¼ gr. of morphine, continuing the same as needed, at the same time giving as much brandy as he could swallow—in all about six ounces during the night. Ice compresses were placed to anterior wound, and hard linen ones to posterior exit of ball. Two minims of tincture of aconite were given every two hours next day, with small pieces of ice in mouth to allay thirst; patient kept absolutely quiet on back; apparently little hemorrhage, and no blood expectorated; no color in face or lips; very anxious expression; passed urine in small quantities and infrequently. More comfortable during second night, but somewhat delirious. Pulse 120–130, short and quick, feeling the effects of stimulus; catheter necessary to relieve bladder of a large quantity of urine; no desire to move bowels; very restless third night, starting suddenly and saying he would die if something was not done for his relief. Under assuring words and medicine he quieted down. Complained of bed feeling hot; changed same, but not his shirt in which he was wounded. He had bled sufficiently to saturate two thick hair mattresses, and blood was beginning to drop to the floor. Fifth day expression improved somewhat, and pulse, under aconite, reduced to about 100; respiration easier. Air passed in and out through both wounds when compresses were removed. Evidently a large branch bronchial tube had been injured. Same general treatment continued until June 28, eighth day, when aconite was discontinued. Bowels moved and patient passed urine freely in normal manner; appetite good; partook freely of beef tea, soft cooked eggs, etc. Patient had been a prisoner for several months in rebel prison in 1864–1865, and we feared a return of the chronic diarrhœa he then suffered from. Free discharge commenced at this time, June 28, from both wounds, at first clotted blood, then pus. Wound was kept clean by frequent washing with soap and warm water and a saturated solution of chlorinate of soda, also the use of a silver drainage tube posteriorly. July 12, general condition much improved; no secondary hemorrhages; treatment continued about the same; very small amount of stimulant given. Anterior wound healed; pus still discharging from posterior wound; there seemed no way of measuring the quantity, yet it saturated a large pad and the back of his woollen shirt twice in twenty-four hours. Morphine in divided doses during the night to make him rest easily; tincture of iron continued, and some color in lips, but not much in face and his hands were pearly white. July 15, in A.M. had a decided chill, not very free perspiration following; entire loss of appetite with some looseness of bowels; reason to fear pyæmia; gave free doses of quinine and stimulants. Chill did not return and in a few days he felt better.

July 28, I removed several portions of the necrosed scapula; respiration good in lower lobe of left lung; lack of it, with entire dulness, on percussion of upper lobe. Discharge from posterior wound enormous.

August 3, patient can now sit up in bed and is able to be moved to his home in Westchester. The journey did not seem to exhaust him a great deal. He did well for about a week when a severe attack of dysentery came on and reduced him rapidly. This yielded to treatment, and without further hindrance he continued to improve, and in a month was able to leave his bed. The discharge of pus continued quite freely for a time but gradually ceased, and on October 15 the posterior wound had healed entirely. Marked depression under left clavicle and some drooping of left shoulder; auscultation and percussion showed little use of upper lobe of left lung. He began a gradual course of exercise, continued his good diet and improved very rapidly.

July 4, 1866, I was surprised to see what a complete recovery he had made. He had entire use of the lung, except a small portion of the apex, apparently just above the track of the ball.

There are some points of particular interest in this case:

1. As to the great amount of blood lost, and the probable result had the wounds been closed in accordance with Dr. Howard's method, and the blood allowed, or forced, to remain in the cavity of the thorax.

2. The enormous quantity of pus discharged and in spite of this the ability of the patient to keep up.

3. The entire recovery of lung after it had been so long out of use, or in a state of collapse. In this case there was marked empyema. We attempted relief from this condition by using a silver tube and keeping the wound in a dependent position, which I think was most beneficial.

In January, 1909, I had an opportunty of examining this wound, at Los Angeles, Cal. The Major had been living in southern California for two winters, the climate appealing to him as affording more comfort than that of New York. Scarcely a scar could be seen at the point of entrance and exit. He had perfect use of his arms, and Dr. Poddinger, who was so kind as to examine him, assured me the lung was quite normal in its function.

This case in my earlier years gave me much comfort in the treatment of cases of empyema, traumatic or otherwise.

As late as 1878, Powell, who was one of the best authorities at that time, in writing upon the subject of empyema said: "As it is clear that we cannot empty the pleura even in recent cases without admitting air in place of fluid, we must adopt one of three methods: (1) Either to disinfect the air admitted into the pleura, and having inserted a cannula, to close the wound with antiseptic dressings to be renewed with the same precautions every three or four days; or, (2) to make a double opening and introduce a drainage tube, so as to permit the escape of pus as rapidly as formed; or, (3) to make a single incision or free opening and insert a tube through which the pleura can be daily washed out with some disinfecting fluid." Of these three methods he says the first is to be preferred. At this period, or about 1880, and for the next five years, the discussion that older physicians gave the treatment of empyæma, either by tapping or drainage, and finally, much later, by resection of the ribs, was most strenuous. My own experience with individual and older physicians was most emphatic. Occasional reports of a single case, by earnest operators, such as Martindale, of Port Richmond, presented in the *American Journal of the Medical Sciences,* July, 1881, were well worth studying, and illustrated the good effect of through and through drainage. In the *Medical News,* May 7, 1887, Dr. Strickler of Colorado Springs presents a most interesting paper on resection of the ribs and the treatment of empyema, but at this late period the old theories were in his mind, for here he states, " that no disturbance was caused by the admission of air into the chest cavity."

In my own mind, the decade from 1880 to 1890 presented a period of time when I had worked out the treatment of pleuritic effusion, and it has been my guide since. Antiseptic surgery, by means of the carbolized spray and aspirator, was not practicable in the treatment of such cases, and this became my formula: In a diagnosis of pleuritic effusion, when the temperature and pulse indicated that the fluid was yet sterile serum, I have insisted upon a very thorough effort at medical treatment being made, such as the use of a thoroughly dry diet, local application of blisters, free evacuation of the bowels, outdoor exposure, and plenty of sleep, and I have seen many happy results, both in children and adults, the latter more particularly. When there is a rise in temperature, increase in the pulse rate, perhaps a chill, and later a marked leucocytosis, and the suspicion arises that pus may be present, I have always insisted upon a free evacuation, but I have had strange experiences occasionally. The evacuation of pus by means of the trocar would result in the recovery of the patient, and this case was held up as an illustration by many conservative physicians in the neighborhood as one in which even drainage by means of the rubber tube was not necessary. Any excuse was offered for non-operative intervention. This, however, was finally the ground of compromise: That if the trocar and the drainage tube did not bring about a good result within a reasonable time, I was not willing to yield any further to the conservatism of the good and respected family physician. If, however, the fluid remains sterile I believe a small percentage of these cases will recover by judicious, repeated use of the aspirator, but when once pus is discovered the use of the trocar and introduction of the rubber drainage tube is admissible, having the opening as low down as possible, and keeping the tube within the pus cavity. This treatment in cases under twenty-one years of age gives a very large percentage of recoveries. Failing, however, at this time in life, and particularly after the age of twenty-five, in this line of treatment, then resection of one, two, three, or four ribs, two to five inches, becomes necessary.

I have a record of a number of cases of pleurisy associated with malignant conditions not only of the lung but of growths elsewhere, in which the patient suffered from the associated attacks of pleurisy, and where I have seen marked relief from simple aspiration, going no further in other cases than to introduce the rubber drainage tube.

Cases of double empyema have, in my practice, been very rare. Much has been said regarding the danger of syncope and death, in the evacuation of pus, in all cases, either double or single, but the only fatal case I have encountered was that of a boy four years of age, who was suffering from double empyema, who had little breathing space left, and was very nervous and frightened at the thought of having anything done. Local anæsthesia was attempted, but his struggles were so great we were finally forced to give him a general anæsthetic, and just as I was puncturing the right chest the little fellow collapsed and expired. It has been my custom to evacuate the chest with great care, always insisting upon the horizontal position of the patient, and I have seldom seen a case of syncope. This case was a sad one in many ways and not infrequently quoted by friends when a similar line of procedure was suggested.

The use of the rubber drainage tube as the sole dependence in the treatment of cases of empyema, especially in adults, cannot be considered as a successful method. In children it is likely to produce more serious deformity, and adults, if they do not recover at once, undergo a prolonged illness. Unless the patient's surroundings are especially good, and the previous family history above all possible suspicion, I have noticed that tuberculosis, in many instances, presents as the final condition.

It is interesting to note how the cavity of the pleura is disturbed and the distressing cough and irritable conditions that present when the loss of the drainage tube takes place. I have been called to see these cases and have noticed the great disturbances that presented in a train of symptoms having a most depressing, unpleasant effect upon the patient and friends, but I have not yet met with a case in which a foreign substance eluded resection, an accident that ought not to occur.

That empyema has claimed many methods and a great variety of operations for its relief cannot be denied, but like many surgical questions the solution has been delayed through the tenacity with which the family physician would, in former days, adhere to milder surgical procedures; this, however, is finally passing away. Their views were greatly to be respected and their arguments for a conservative line of treatment of these cases met with some success, but I am convinced, and feel able to assert that there can be no longer any doubt that the sooner a case of empyema is relieved (that in a number of cases resection of the rib is really necessary), and that this line of treatment must prevail to a greater degree in the future than in the past.

In the washing out of the cavity, after resection, and when employing simple drainage by means of the rubber drainage tube, I have had my attention called to the unpleasant effect of the use of peroxide of hydrogen. This is to be expected, and long since I have counselled against this antiseptic, employing much milder preparations which do not give the patient so much distress.

I have observed with much interest the cases that have come to me, and in which I have been called in consultation, where the patient had a rapid change from the formation of serous effusion into that of pus, and the general infection of the system, as illustrated by the following case:

M. R. æt. four years; history of tuberculosis on maternal and paternal sides. Case came under observation July 3, 1908.

Previous history: Supposed to have had enteric fever when an infant; a year ago suffered from quite a severe attack of whooping cough; ten weeks ago had an attack of measles, later followed by pneumonia. In the early part of the attack of measles patient had otitis media of right ear, and which soon discharged quite freely. About this time left knee began to swell, and a week later swelling of the right shoulder. At the end of five weeks drainage tube was introduced and pus drained from bursa of left knee and abscess about right shoulder. Two weeks later empyema presented and trocar used, with introduction of rubber drainage tube in right pleural cavity. Knee and shoulder improved but drainage from side not satisfactory. July 3, 1908, two ribs were thoroughly resected and an abscess containing about 500 c.c. of purulent fluid escaped. Drainage continued very profuse. From this time on patient improved rapidly and has made a splendid recovery.

That repeated cases of pneumonia often deceive the general practitioner, regarding the complication of empyema, and as to the possibility of tuberculosis being present, is, in my mind, a fact.

I have sometimes witnessed a very earnest discussion, on consultation, as to whether the case was one of simple plastic pleurisy, one of chronic consolidation, or one of true empyema, and I have no doubt in my mind that there are many cases of pneumonia associated with pleurisy in which an unexpected condition of empyema creeps in and is present without being recognized as promptly as it should by the family physician. The following case, one of many, is of some value in illustrating this point:

J. W., æt. 45 years, farmer by occupation. May 8, 1908, suffered from pain in right side, and in June had an attack of pneumonia, same side. This was followed by attacks of coughing and pain on inspiration. Cough paroxysmal, which had persisted since onset, usually occurring during morning hours, at which time patient expectorated freely, coughing up profuse secretion, described as resembling oyster juice, with sweetish taste, but free from odor. At times he had expectorated a quart of this material, and not infrequently a pint or more. During attacks pain was present on right side of chest. Had lost in weight and strength. No history of night sweats; otherwise history negative. There was much discussion as to the case being one of tuberculosis or consolidation from pneumonia, possibly plastic pleurisy, but with no admission as to empyema being present. Blood count did not show a leucocytosis above 6250. Frequent examination of sputum showed an enormous number of pus cells, but no tuberculosis.

May 14, 1908, I believed the patient was suffering from empyema, and did a thorough resection of the fifth and sixth ribs, opening into a large abscess cavity with an adhesion to the fourth and fifth ribs and to the pleura that acted, as the lung had contracted, to give it the appearance of an hour-glass contraction. These adhesions were loosened and revealed a free opening into a large bronchus, also marked necrosis of the ribs. This cavity was well packed with three large tampons of sterile gauze and around a large rubber drainage tube. The patient made an uninterrupted recovery, cough abating at once, expectoration ceased, he gained rapidly in flesh and has made a good recovery, with the exception of a slight sinus, about two or three inches in depth which remained when he was last examined, April 1, 1909. The lung had returned to its normal condition regarding function. It is very impressive to note how cases of empyema will go on, the patients remaining invalids, and treated for one condition and another, but when at last reached are not unlike those of neglected appendicitis.

For some time I have discouraged the use of iodoform gauze as a dressing, and for treatment of the large cavity that remains after resection of the ribs I make use of either vermiform or just plain sterilized gauze. I believe it is well to pack the cavity somewhat firmly at first, so that the lung is not embarrassed by the lack of support, the patient is made more comfortable, and then, at the end of forty-eight hours removed and packed much more lightly.

The use of the hypodermic syringe as a means of diagnosis is of vast help; the use of the aspirator in evacuating a chest that contains aseptic fluids is to be commended, and the use of the instrument can be repeated a number of times, but great care should be exercised in the laboratory examination of the fluid withdrawn, the least indication of pus that presents being a warning for the abandonment of this method.

I have been greatly impressed with the reports coming from the laboratory regarding the mixed infection that presents in cases of empyema, and how very seldom the bacilli of tuberculosis are found.

I have also been very much impressed regarding the length of time that pus has existed, or where the condition of empyema has been present, in the cases that have come under my observation, and of which the following are but illustrations of others:

G. F. C., æt. thirty-nine years, salesman by occupation, came under observation November 7, 1904. Patient had had diseases of childhood, during which time he was supposed to have had pleurisy.

Present illness: Four years ago was ill for three days with a diagnosis of pleurisy of right side. Recovered and apparently well for two years when an abscess presented to the right of right nipple, which was lanced, discharged quite freely, healed for some time, formed again later and discharged for six months. Then another abscess formed nearer nipple which was also lanced. This has been discharging ever since, and particularly profuse for past four weeks. Patient's weight has remained about the same. This abscess was very annoying in getting about to his business.

I advised resection of ribs, which was done November 8, 1904, resecting about four inches in length of fifth, sixth and seventh ribs, when an abscess was opened into, connecting with the sinus, abscess extending from apex of the lung to the diaphragm and having a capacity of about thirty fluid ounces. Lung completely walled off, and surface of the pleural cavity lined with a thick calcareous coating. The latter was dissected out as much as possible and cavity then packed with plain gauze around a large rubber drainage tube. Gauze gradually removed and drainage tube relied upon, through which irrigation was kept up, patient making a good recovery. January 6, and March 12, 1905, family physician, as well as patient, reported a steady improvement. Again in the spring of 1906 report came that he was doing well but a short sinus persisted. Lung had expanded well.

I have been interested in noting the phosphatic deposits that are found in long-standing cases of infection of the pleura, and I believe that better results come from attempting to dissect out, as carefully as possible, that portion of the thickened pleura which can be reached.

Cases of empyema or multiple abscess, particularly in children, are the ones to watch with prompt care, and we should not fail to make our operations thorough. I fear that at times we fail, perhaps, in giving full relief, as the following case illustrates:

M. H., æt. six years, came under observation February 12, 1904. Principal symptom that of a persistent cough and P.M. temperature. Family history negative. Whooping cough at the age of three years, followed by measles in the winter of 1901. This followed in turn by what was believed to be bronchitis which left her with a cough resisting all treatment and which has persisted ever since. May, 1903, had bronchial pneumonia, recovered and apparently well except for the cough. About four weeks ago child's temperature would rise at three P.M. to 102–103. This would persist until seven P.M., when it would gradually abate. Has been greatly weakened by a persistent diarrhœa. Appetite not good. In coughing raises nothing but white, mucus-like substance; no tubercular bacilli present on examination. About this time an abscess formed in right side of chest and discharged quite freely. There was much dulness on percussion, with zones of respiratory murmur. The case believed to be one of empyema unrelieved by the sinus, and an operation advised. Sixth and seventh ribs resected, one and one-half to two inches in length, and abscess cavity opened into just above the termination of the old sinus. Quite an amount of pus escaped and cavity packed with iodoform gauze. Operation fifteen minutes, under chloroform. Bacteriological examination at the Bender Laboratory showed cocci and bacilli, and cultures showed diplococcus pneumonia. Patient improved somewhat at first, was much more comfortable, but temperature gradually increased, reaching 107.6°, then declined to 105° when she died somewhat unexpectedly. No autopsy. I believe this patient was suffering from multiple abscesses and entire relief was not afforded.

The next case is somewhat in contrast:

I. E., æt. six years, came under observation January 9, 1905. September 21, 1904, had suffered pain in chest, vomiting, fever, loss of appetite and severe cold. Child treated for typhoid fever for five weeks. Previous history had always been good. Now another physician called who diagnosed empyema. Patient was sent to a local hospital, where two incisions were made in side, but with negative results. January 9, 1905, patient was brought to the Albany Hospital and resection of ribs determined upon, believing the child was suffering from empyema. Thorough resection of fifth rib done and cavity opened into very promptly. In introducing fingers two or three cavities were distinctly located and opened. Gauze tampon used for drainage for some few days, then rubber drainage tube, and irrigation. Respiration had been rapid but gradually dropped to twenty-four. Temperature for first few days between 100° and 100.5°, then gradually came down to about normal. This patient made a good recovery.

As a contrast to the first case of gunshot wound reported in this paper the following is somewhat interesting:

P. S., Hungarian, æt. 27, during a quarrel on the night of November 2, 1908, was shot in the right side and fourth rib severely fractured. He was brought to the hospital at once, and the same day my son, Dr. Edgar, opened the wound freely, removed a good portion of the rib, recovered the bullet, found pleura quite badly lacerated, some considerable hemorrhage, and wound packed with plain gauze around rubber drainage tube. Patient somewhat uncomfortable a few days after the operation; some difficulty in breathing; temperature at one time 103°, some purulent discharge, but all these conditions abated gradually and patient made a good recovery.

In the study of cases that have come to me, and in some of my own, I have been somewhat disconcerted by having them go on nicely after thorough resection of the ribs, but finally ending in a sinus that was exceedingly troublesome and difficult to close. For instance, Mr. D. gives a good representation of this condition, and upon this point I trust we may hear some discussion:

M. M. D., ætat 34, agent by occupation, had typhoid pneumonia ten years ago, followed by empyema. An abscess followed later and for eight years sinus in right side had persisted. He had kept this sinus open, which led from pleural cavity, and discharge very slight. April 24, 1907, patient very anxious for permanent relief, condition incapacitating him for work and he wanted to get well. General condition otherwise very good. He entered the Albany Hospital and resection to the extent of three inches was done in sixth, seventh and eighth ribs, in axillary line, right side, and quite an extensive abscess cavity was opened into. Patient went on to complete recovery, gained in flesh, returned to his work, and able to do as much as ever, but December, 1908, there was yet a sinus about four or five inches in length which would hold about one-half ounce, which would not heal under any form of treatment followed out.

In the chronic state of these sinuses I would be very glad to hear from any of our associates who have had an experience in the use of paraffin in the treatment of these cases.

In the treatment of sinuses I am quite sure that the drainage tube or method of drainage is somewhat responsible, that at times the packing is too earnest and the tube is left in too long, not granting sufficient opportunity for the expansion of the lung. Where the lung does expand rapidly a sinus is not so likely to form. This is one point I believe in favor of an early operation, therefore, I use it as an argument with the family physician to avoid delay in these cases.

In the study of my cases of empyema I have been greatly impressed to note what a large proportion occur on the right side.

As remarked, it is most impressive to note the duration of the history of cases of empyema and their association with what might be termed a tubercular predisposition.

J. W. B., æt. 39, a bottler by occupation, came under observation May 18, 1903. One sister had died of tuberculosis. Sputum thoroughly examined and negative of tuberculosis. Blood examination: Leucocytosis 8000, and many polynuclear leucocytes present. Patient gave a history of cough and expectoration of blood for fifteen years. Four years ago had a distinct pleurisy in left side, since which time noticed respiration had been difficult and somewhat rapid. November, 1902, contracted a severe cold and since then unable to work. His family physician made the diagnosis of empyema and did two aspirations, but with little benefit. May, 1903, an abscess was opened between eighth and ninth ribs, under ethel chloride, and a large amount of pus evacuated. On May 19 another incision was made with a somewhat similar result, but his symptoms did not improve, temperature not lessened, and he was advised to enter the Albany Hospital. May 27 I did a thorough operation and found a sinus that extended to the intercostal space between the eighth and ninth ribs, which was carefully dissected out, and which had communicated with the pleural cavity. Seventh and eighth ribs resected to the extent of nearly four inches, this opening into a large abscess cavity from which a pint of pus was evacuated. A large rubber drainage tube inserted and packed about with iodoform gauze. Gauze removed at the end of forty-eight hours and abscess cavity irrigated with boric acid solution, a drachm to the pint. After this operation his temperature became normal, cough ceased, appetite returned, general functions of the body became normal, and patient left the hospital at the end of the third week, improving in every respect and ultimately making a good recovery. I regret to say the hospital record fails to note and report on examination of sputum, on his discharge, for tuberculosis. His clinical history and appearance was that of tubercular trouble.

In a number of my operations for the relief of empyema I have seen good results following the bottle method of exercising the lung to produce expansion.

Summary.—1. That the hypodermic syringe, with a long needle, is of value for exploratory purposes.

2. That the repeated use of the aspirator is not to be condemned so long as the fluid remains sterile, and its use is the preferable method of treatment in malignant cases.

3. That the use of the trocar and drainage tube is advisable after it is shown that the aspirator is no longer affording benefit.

4. That resection of the ribs is absolutely necessary when no improvement takes place with the ordinary drainage tube.

5. The latter operation to be done early, in order to protect the lung from unnecessary pressure and to relieve the adhesions that, in the young, become so detrimental in causing spinal curvature.

ŒSOPHAGOGASTROSTOMY AFTER INTRATHORACIC RESECTION OF THE ŒSOPHAGUS.*

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SINCE the last portion of the body, the thoracic cavity, has been definitely opened to surgery as a result of the introduction of the principle of operating under differential air pressure, the treatment of the diseases of the organs situated within the chest as well as the diseases of the chest wall itself, has, of course, become greatly facilitated.

Next to pleura, lungs and heart, it is the œsophagus that now can be safely attacked by the surgeon also in its thoracic portion. While access to the other organs named has been had before the advent of operations under differential pressure, there is great risk connected with such operations in view of the always threatening pneumothorax. Still there was at least a possibility of doing the work. It has been different with the œsophagus in its thoracic portion. This has always been a *noli me tangere,* at least as far as a direct route through the thoracic wall was concerned, and this owing to the fact that as soon as the œsophagus is lifted out of its bed both pleural cavities are liable to be opened. Thanks to the work of Sauerbruch and Brauer we now have access also to the œsophagus by the straight, direct route, with the same safety with which we approach the intra-abdominal organs.

Of the various diseases of the œsophagus it is principally cancer—this up-to-date inevitably fatal disease of the œsophagus—which has now been placed within the focus of surgical interest and attack. So far every single patient with malignant stricture has had to die of the disease. When such a case came under our care, we usually took the family into our confidence, stating the helplessness of operative surgery in this particular affliction and admitting that the patient was absolutely doomed. The latter usually was told for humane reasons that a stricture existed between mouth and stomach, for which a gastric fistula would have to be established, to prevent death from starvation, and that, by feeding through the tube and giving rest to the diseased part of the œsophagus for a time, the constriction would probably yield within a few months. And when the "few months" had passed, the patient also was usually ready to pass away. Others condemned all operative treatment in these cases and kept the passage to the stomach patent with the help of bougies regularly introduced as long as this was possible, soothing the patient with hopes that could, of course, never be realized: And all this in dealing with a carcinoma, that may well be pronounced the most benign of all of them, one that has little tendency to produce early metastases, and affects the glands only when the border lines of the œsophagus itself have been transgressed by the disease. I say, all this with a carcinoma the presence of which, even in its early stages, can be diagnosed without much difficulty.

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* Read before the American Surgical Association, June 4, 1909.

It was but natural that with the introduction of differential pressure operations five years ago great hopes were at once entertained as to our being able to take up at last the cudgels also against this disease and to combat it successfully.

While it may be disappointing that so far, out of about twenty patients operated upon for cancer of the œsophagus, by six different European surgeons, not one has recovered, it is to be regretted that such a small number of failures should have induced Sauerbruch to say in his latest publication on this subject, which appeared only two months ago (*Deutsche Zeitschr. f. Chir.*, vol. xcviii 2 and 3, March, 1909), that his hopes of obtaining success in operating for œsophageal carcinoma are greatly reduced and that the indications for operative interference must be drawn extremely narrow.

The cause of the unsatisfactory results has been: First the great advance the disease had already made in most of the cases cited by him when they came under the knife; Secondly, the extreme sensitiveness of the pleura and especially of the loose connective tissue of the posterior mediastinum to the highly infectious mucous secretions of the œsophagus, and that in spite of the most rigid asepsis; Thirdly, the absence of a pleural cover to the lower third of the œsophagus; Fourthly, the lack of a safe method of operation.

Still, it seems to me that the only way to make progress in the direction of combating œsophageal cancer, is to go right on, regardless of past failures, endeavoring to improve our methods and to try to overcome the many obstacles; to encourage, rather than to discourage the profession as well as the laity to have an *exploratory thoracotomy* made in every instance, where the suspicion of the presence of an œsophageal carcinoma has arisen. That is the time when the attempt should be made to save the patient. Without operation the patient is absolutely lost; with it he has at least a chance.

Of course, if a major operation is refused, after exploratory thoracotomy has revealed a suspected carcinoma, the wound must be closed and the patient left to his fate. With the help of a gastric fistula his life may perhaps be prolonged, but his only chance of a cure has been irreparably and irrevocably lost. Here, as well as with cancer elsewhere, early diagnosis to be followed up with prompt and proper surgical intervention, is the all important point.

It is certainly true that personally, I cannot so far point to a single case of œsophagogastrostomy performed on the human subject. I have done but one exploratory thoracotomy for cancer of the œsophagus on a human, and my opinion may, therefore, not be of much weight when compared with that of our more experienced European colleagues. My deductions are made from the history of the operative treatment of cancer of the stomach. Did we not there too have difficulties to overcome, which in the beginning looked almost insurmountable? Did the first twenty mishaps in that field discourage us from continuing our efforts to obtain better results?

Think of the great mortality observed during the first years of gastrectomy for carcinoma and the greatly improved results obtained to-day. Surely, deductions based on but five years' work in attacking œsophageal carcinoma, the most difficult task in all surgery, can have no claim to being considered conclusive. Even should the first 50 or 100 or 200 cases operated upon for cancer of the œsophagus die, may be the 51st, 101st or 201st will live. They are lost anyway, and what a terrible death most of them do die!

When I commenced my research work in intrathoracic surgery on dogs at the Rockefeller Institute of New York City, in the middle of November, 1908, one of my aims was the finding of a method of œsophagogastrostomy after resection of the œsophagus, that would answer the requirements of everyday practical surgery, a method, which should come nearest to excluding the possibility of infection following the dividing of the œsophagus, insure a reliable approximation, avoid leakage after the approximation has been made and maintain the necessary patency of the canal.

I hope I have found a method which comes up to most, if not all of these requirements. In working it out, the leading idea has been to avoid penetrating the wall of the proximal stump of the œsophagus laterally. Only in this way is the surgeon able to prevent exit even of a drop of the highly infectious contents of the œsophagus above the stricture. There is no other way of accomplishing that than to implant the temporarily tied proximal stump of the œsophagus into the stomach.

In my work at the Rockefeller Institute I was assisted by Dr. Martin Rehling, my adjunct attending surgeon at the German Hospital. I gladly take also this opportunity of expressing to him my sincere thanks for his most faithful and able help and the many excellent suggestions he made in the course of our work. No less am I indebted to Dr. Edward Adams, formerly of the house staff of the German Hospital, now instructor in surgery at the New York Post-Graduate Medical School and Hospital, who, with an attendant, regularly conducted the general anæsthesia in my operations. Further members of the crew required for the work were, a nurse to hand instruments, sponges and dressings, and a man whose only business it was to attend to the setting of the valves and to the proper regulation of the differential pressure.

Before describing my operative method as I have evolved it in the course of my experimental work during the last six months, it would seem proper to say a few words on the apparatus used.

The portable chamber which Dr. Sauerbruch courteously left here for my use last summer, after he had shown it before the surgical section of the American Medical Association at its Chicago meeting in June, permits of work under positive as well as negative pressure. For operations under partial vacuum, everything required for an operation had, of course, to be taken inside of the cabinet before its door was closed; and, once the vacuum established, the door could not be opened again. Communication with the outside world was then cut off. Under this arrangement the anæsthetizer sat outside of the box. The chamber was so small, that with surgeon and assistant placed inside, it was impossible to maintain proper asepsis. Consequently I reversed the order of things, put the narcotizer inside of the chamber under increased pressure and doing my work outside of it under atmospheric pressure.

During all this time I proceeded with the getting up of a different kind of apparatus.

It was built for me under my direction and guidance by my brother Julius Meyer, an engineer by profession. The first completed specimen thereof was brought into the Rockefeller Institute on January 8, 1909. This new apparatus, a "Positive Differential Pressure Chamber," has a great many advantages over all other similar apparatus so far known. It will be fully described in a separate article.

I have used the apparatus for the last four months to my entire satisfaction.

An improved chamber of this kind, arranged with an airlock for the admission or exit of one of the two narcotizers in the course of the work, with the necessary machinery mounted on a small cart (power truck), was placed in the German Hospital early in March and has meanwhile been successfully tested there in a number of operations on human beings.

Next I had constructed a chamber in which it is possible to operate either under positive or under negative differential pressure, or under a combination of the two, and which, further, allows the changing from one pressure to the other in the course of one and the same operation, a thing unattainable with any one of the preceding apparatus. Formerly an operation had to be finished under the same kind of pressure under which it had been commenced.

Of this universal differential pressure chamber the aforementioned "positive differential pressure chamber" forms a part.

The universal chamber was completed in April and installed for me at the Rockefeller Institute by my brother at the end of that month. I have used it since May 7th and have been very much pleased with its smooth working. With the aid of this apparatus I will attempt to establish, whether there are indications for the use of negative or positive or a mixed pressure in the case of the diseased human being. The surgeon with his assistants and attendants remains therein in the same place, no matter which kind of pressure be used.

A detailed description also of this apparatus will soon appear in another article.

After this conversion into the developing of improved tools I will now proceed with the description of the work performed with the same.

When resecting the œsophagus, we must be mindful of the fact that this tube cannot be stretched for the purpose of approximating the two ends. The stomach must, therefore, be brought up into the thorax for anastomosis to the proximal portion of the œsophagus, while the distal end is closed and dropped back.

In operating for cancer of the œsophagus, two ways are open to the surgeon:

1. Gaining blunt entrance into the abdominal cavity next to the cardia; transposition of the stomach into the thorax; closure of the rent in the diaphragm by stitching it on to the stomach; resection of the diseased portion of the œsophagus; œsophagogastrostomy.

2. Resection of the diseased portion of the œsophagus; closure of both ends; gastrostomy for permanent feeding.

This method is indicated in cases in which the carcinoma has invaded the upper portion of the intrathoracic part of the œsophagus (behind the aortic arch, for instance). Usually the stomach will not be found sufficiently large, to be pulled up to this place.

Further experience is necessary to find out whether the operative closure of the upper portion of the œsophagus is as well borne. It may be shown that preference should be given to the establishment of an œsophageal fistula in an intercostal space. Still more preferable seems, to pull up a coil of the upper portion of the jejunum into the thorax, and perform œsophagojejunostomy, thus overcoming the annoyance of a permanent gastric fistula.

It is wise to start operation No. 1 with pulling up the stomach above the diaphragm. The amount of its yielding must guide the surgeon in his decision as to which of the two methods had better be employed. Of course, the first is the operation of choice.

The necessity of establishing a permanent gastric fistula for the remainder of the patient's life should not discourage the operator. The writer has a young man of 18 under observation, who was operated upon when a boy five years of age, for an impermeable cicatricial stricture of the œsophagus. The boy has since then, *i.e.* for a period of 13 years, been fed through the gastric fistula that had to be established, and has nevertheless grown up to be a fine strong man.*

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* *Cf.* Medical News, October 29, 1904, and ANNALS OF SURGERY, vol. xlix, p. 260, 1909.

The various steps of the operation as carried out and recommended by the writer to-day are as follows:

1. Incision best in the eighth intercostal space,* in order to be able to easily approach the cardia and determine whether the stomach can be properly pulled into the thoracic cavity. Rib spread or put in place. (Fig. 1.)

Of course, before this, the seat of the disease which had previously been located with the help of the bougie, X-rays (bismuth), and œsophagoscope is investigated by direct palpation.

2. Lung pushed upward and inward by gauze tampons, and œsophagus, with nervi vagi and aorta running along its side, come into view (Fig. 2).

3. The œsophagus is raised from its bed. The surgeon's left forefinger surrounds the œsophagus; nervi vagi stripped off. In doing this the opposite thoracic cavity is frequently opened. No harm results therefrom when working under differential pressure (Fig. 3).†

4. Œsophagus with cardia is pulled up by the left hand, thus putting diaphragm on the stretch. An anatomical forceps is pushed parallel with and to the right of the œsophagus into the abdominal cavity (Fig. 4).

5. By flexing second phalanx of thumb, which rests on the cardia, the stomach wall is rolled upward, grasped with anatomical forceps and then pulled into the thoracic cavity by hand (Fig. 5).

6. The rent in the diaphragm is grasped with a number of tenaculum forceps, care being taken to catch below the diaphragmatic peritoneum. This point is of very great importance, as only by including this part of the peritoneum a rapid and thorough agglutination between stomach and diaphragm can be expected (Fig. 6).

7. Diaphragm stitched to stomach with the help of silk sutures, the assistant pulling on the forceps and the operator introducing his left

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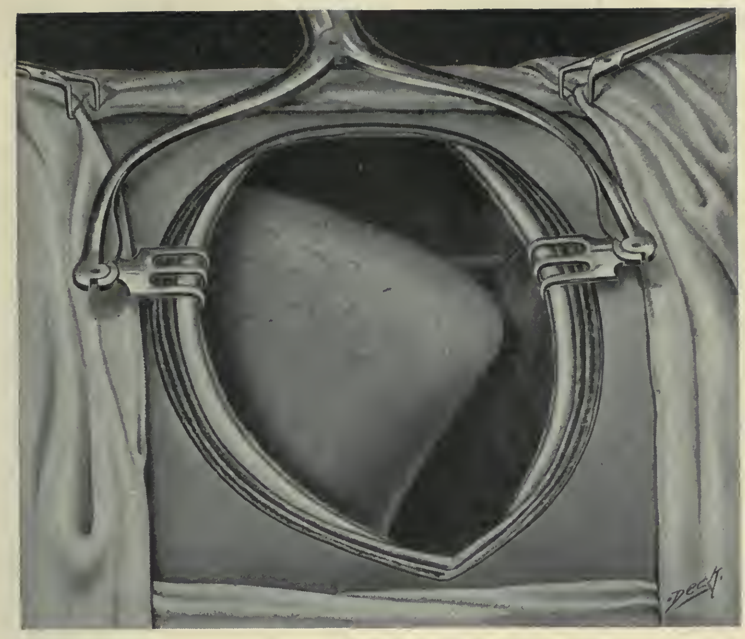
* In dogs the incision in the seventh intercostal space suffices to enable one to do the work including the resection of the œsophagus and the subsequent œsophagogastrostomy, provided only a short piece (not longer than an inch) of the œsophageal tube is excised. If a larger piece is removed, the work with needle and thread becomes unsafe, if not impossible, and a second intercostal incision a little higher up, say in the fifth or sixth intercostal space, will be required. Dogs stand this double incision very nicely. With the greater length of the human thorax this double incision also seems practical, if the surgeon does not prefer a flap formation or the removal of a number of ribs. The preliminary operation on the chest wall will have to be adapted to the individual case. In order not to have the two incisions too close together, I selected the incision in the eighth interspace instead of in the seventh, which latter has so far been preferred by other operators.

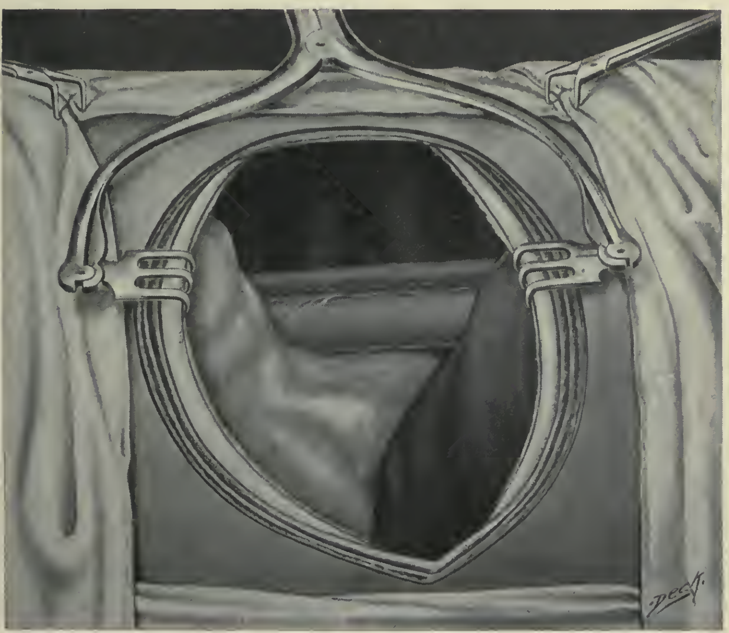
† The wearing of cotton gloves greatly facilitates intrathoracic work. These gloves always give one a firm hold on the organs, which are rather slippery to the bare hand, still more so, of course, when the hands are covered with rubber gloves. I have used cotton gloves in aseptic intrathoracic operations right from the start and should not like to do without them.

Fig. 1.



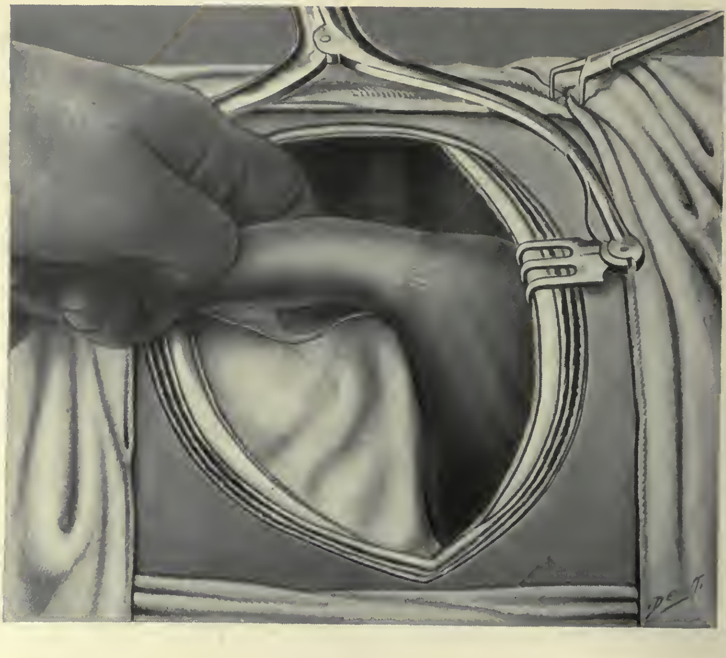
Intercostal incision in eighth interspace Rib spreader in place; to the left, inflated lung as it presents itself under differential pressure; diaphragm to the right, descending aorta and ribs in the background.

Fig. 2.



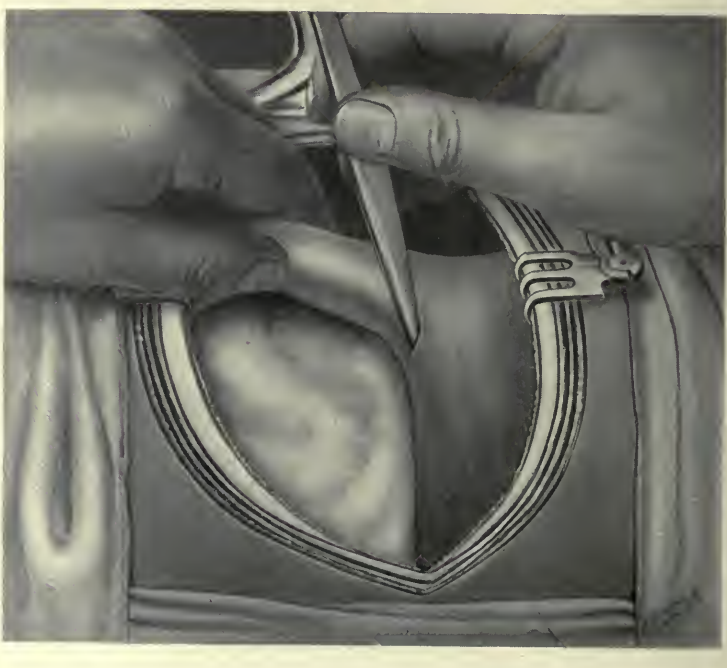
Lung pushed aside by gauze tampon; œsophagus showing in depth of wound, partly covered by pleura; nervi vagi on either side.

Fig. 3.



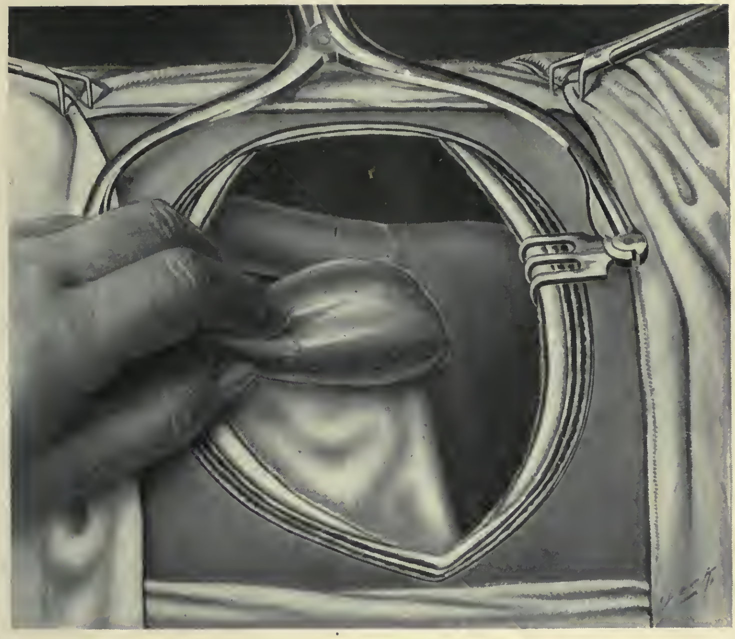
Œsophagus raised, surgeon's forefinger surrounding it. Nervi vagi stripped off.

Fig. 4.



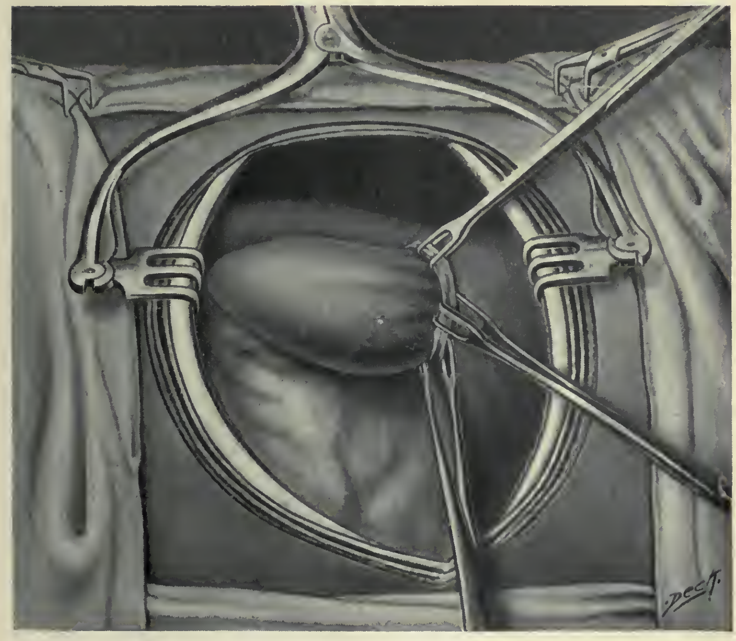
Œsophagus, with entrance to stomach, plus diaphragm pulled upward by left hand; anatomical forceps bluntly entering abdominal cavity to left of cardia. (Forceps in reality inclined more obliquely.)

Fig. 5.



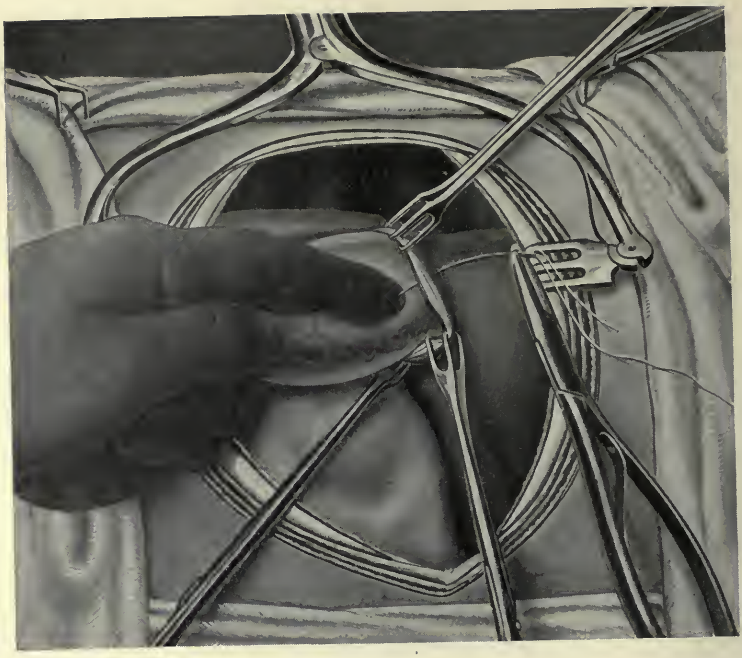
Stomach pulled into thoracic cavity.

Fig. 6.



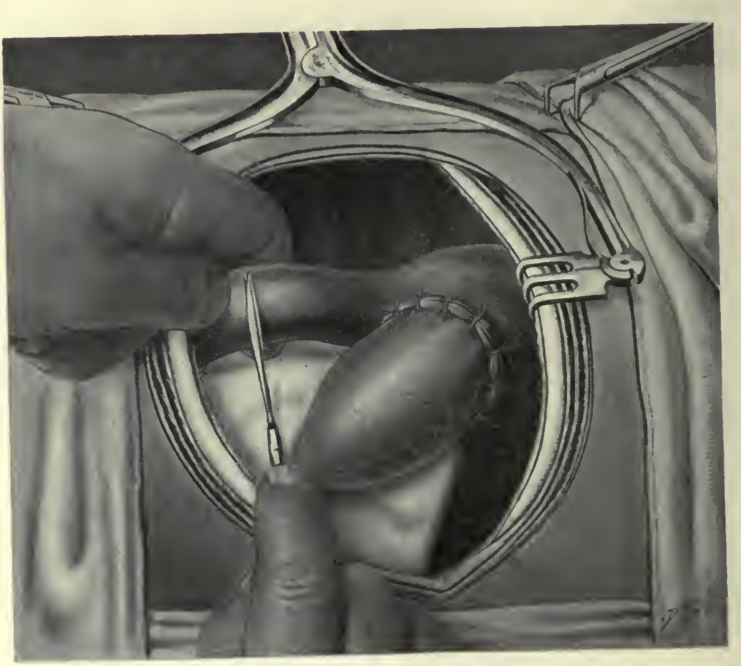
Rent in diaphragm, with diaphragmatic peritoneum caught by tenaculum forceps.

FIG. 7.



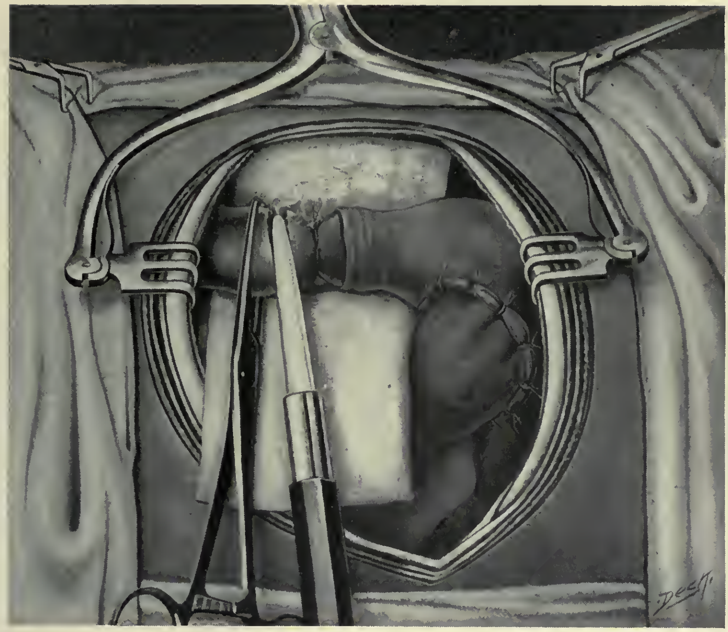
Silk sutures through diaphragm and wall of stomach. Surgeon's left forefinger emerging from abdominal cavity with tip of needle.

FIG. 8.



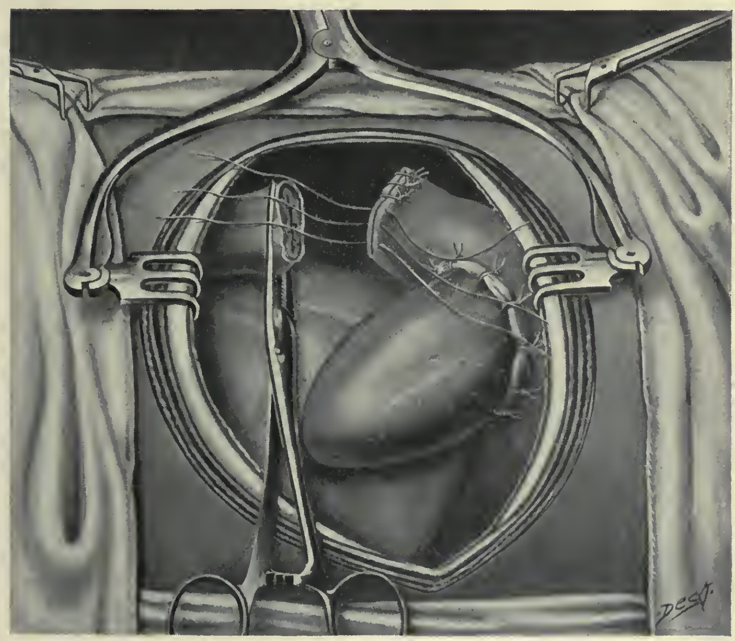
Forefinger surrounding œsophagus; circular incision of muscular coat to form cuff.

FIG. 9.



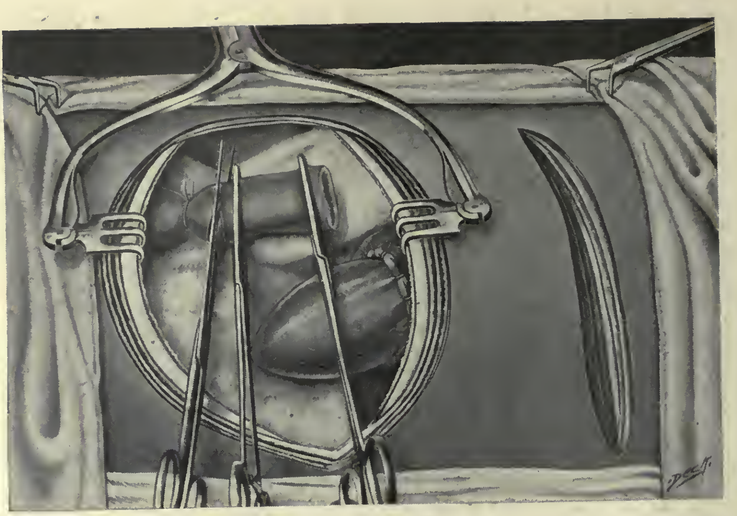
Diaphragmatic rent closed and sutures cut short; narrow tampon below œsophagus; tampon covering stomach not shown. Cuff turned back; inner coat of œsophagus tied and burnt off with Paquelin cautery, clamp closing proximal side of œsophagus.

FIG. 10.



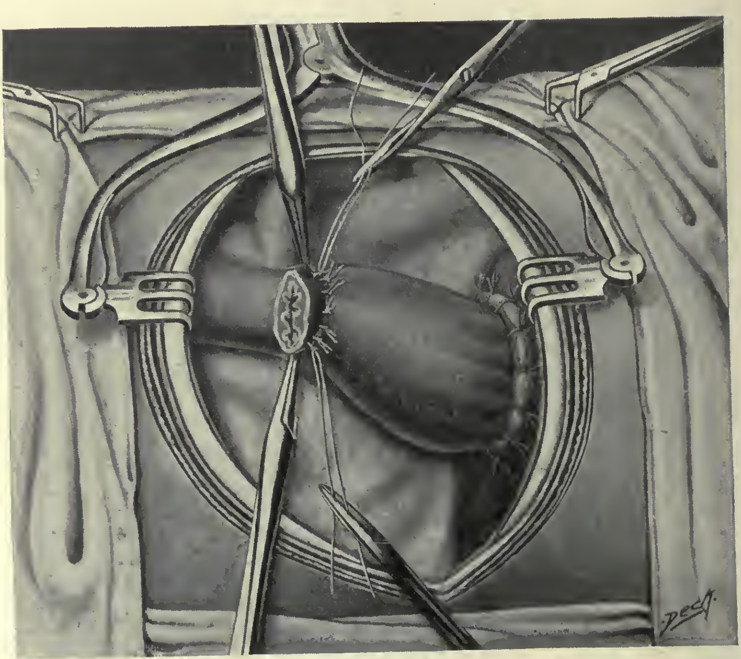
Suturing cuff; to the left, cauterized surface of proximal end of œsophagus.

FIG. 11.



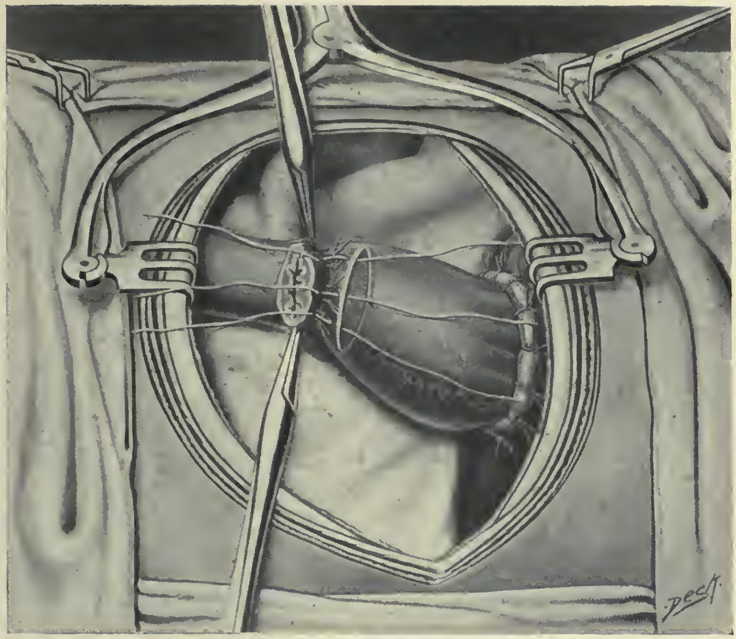
Distal œsophageal stump dropped back, covered with tampon; large curved clamp gently compresses stomach above diaphragm (not shown); second intercostal incision in fifth interspace; upper portion of œsophagus tied with rapidly absorbable catgut ligature; second clamp distally from it; scissors dividing œsophagus.

FIG. 12.



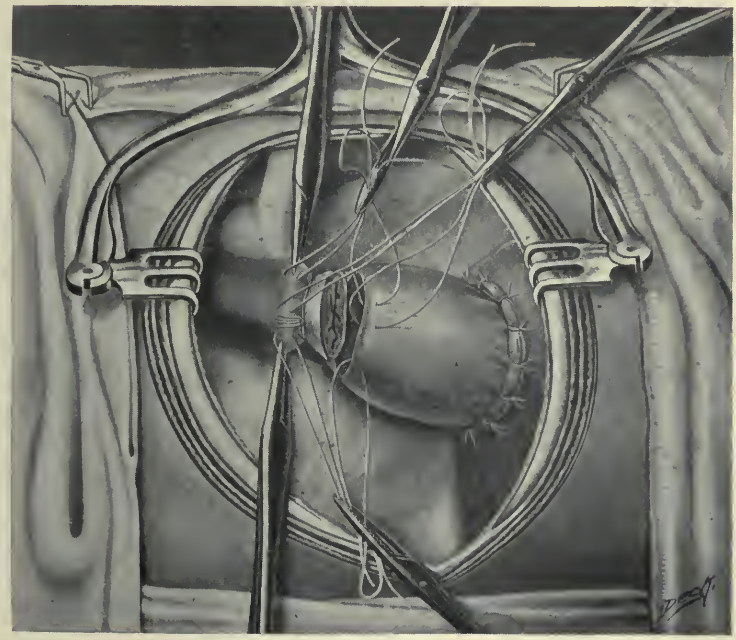
Stump of divided œsophagus drawn up by means of two forceps; wall of stomach stitched to posterior wall of œsophagus by means of silk sutures, which grasp muscularis only; the two farthest sutures, to right and left, clamped to serve as guides later on.

FIG. 13.



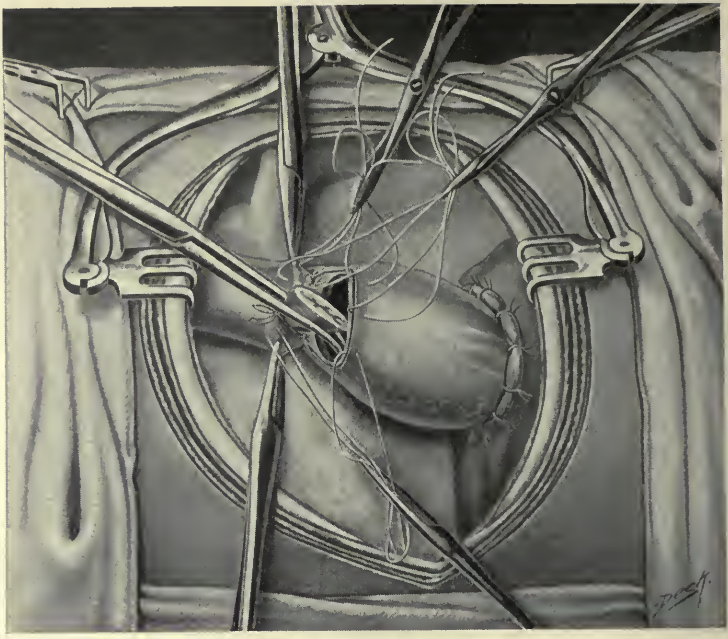
Ellipsoid-shaped excision of seromuscular coat of stomach in a horizontal direction, about three-quarters inch in front of the sutures, showing in depth mucous membrane of stomach not yet divided; the two long lateral sutures shown in Figure 12 omitted in this illustration. Upper lip of stomach wound caught with three sutures, not yet tied, uniting seromuscular coat of stomach with muscularis of œsophagus.

FIG. 14.



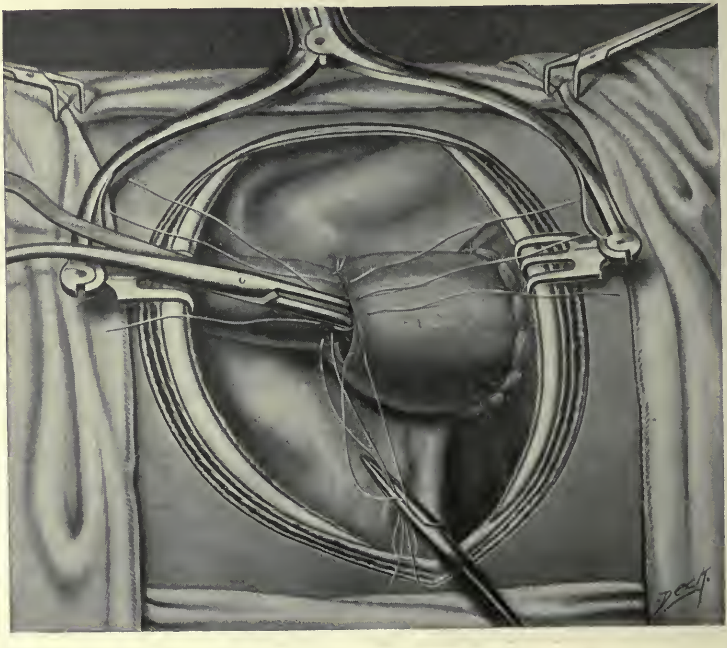
Lower lip of stomach wound and anterior wall of œsophagus caught by long silk sutures, untied, the middle portion of each suture and its two ends caught by an artery clamp.

FIG. 15.



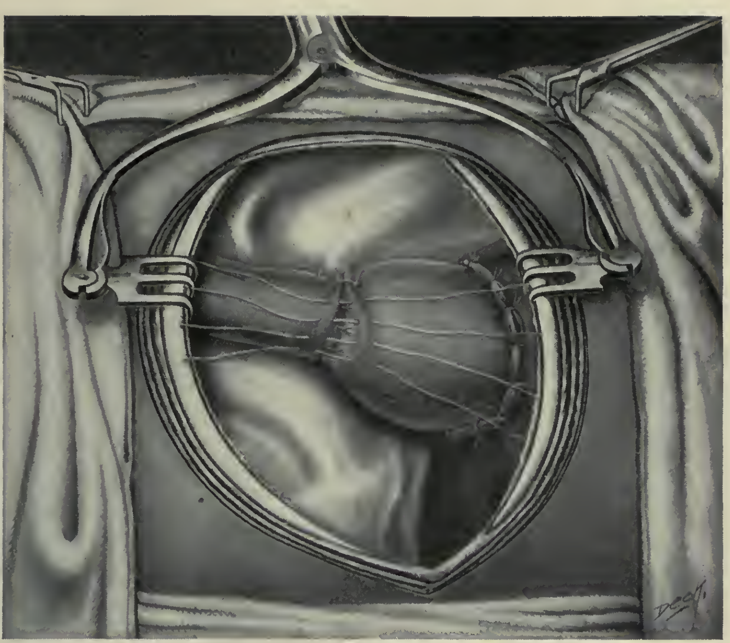
Anterior sutures separated; lower end of œsophagus caught with curved forceps for introduction into stomach.

FIG. 16.



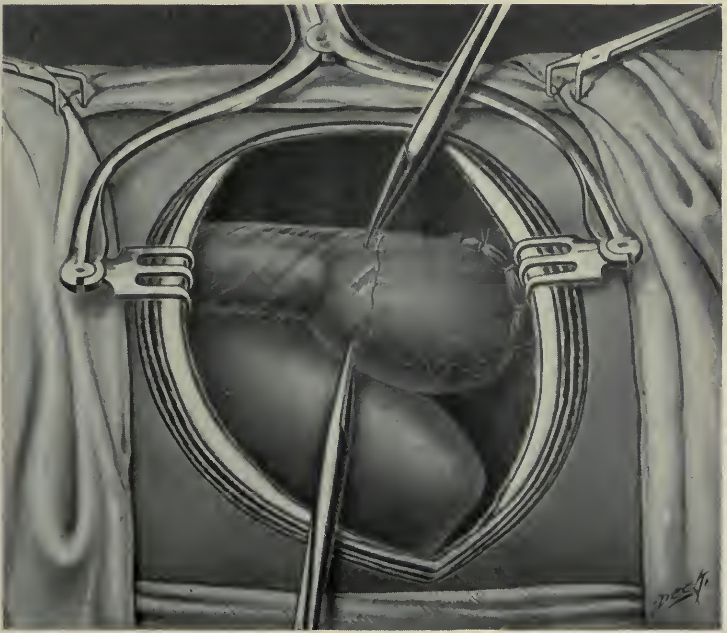
Implantation perfected, closing anterior sutures. Forceps withdrawn when tying middle suture.

FIG. 17.



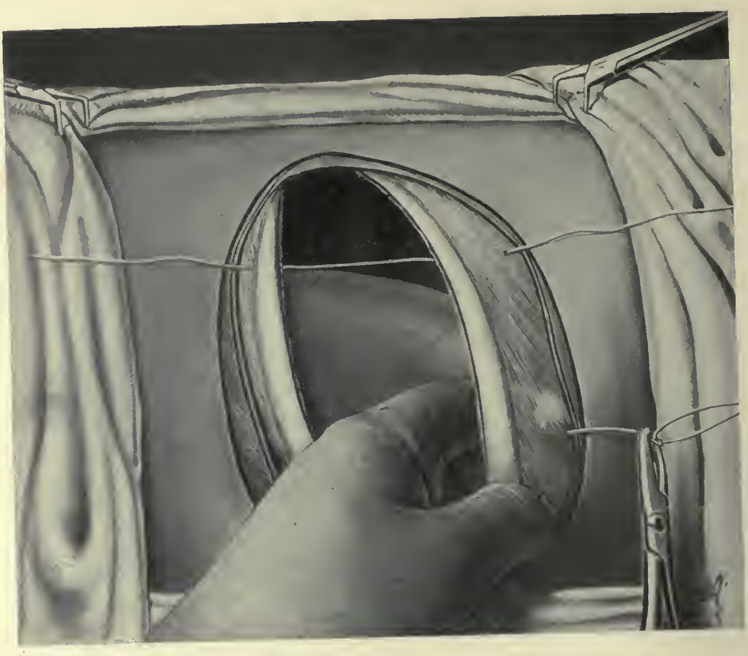
Forceps removed; first row of anterior sutures tied. Second row in progress, to cover front row by drawing a fold of the stomach up to anterior wall of œsophagus.

FIG. 18.



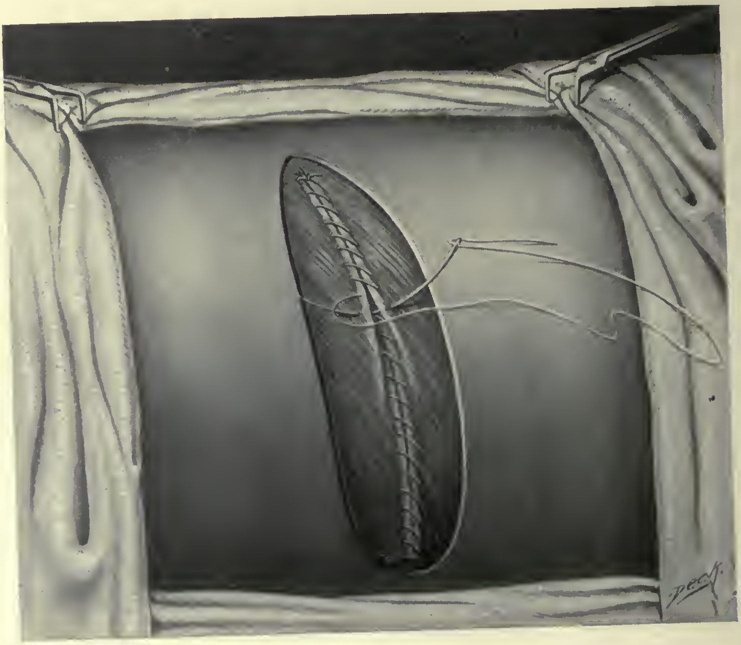
Tampons removed; œsophagus in its normal position, next to spinal column; lower border of pleura, caught with two forceps, stitched onto stomach; anastomosis, seen through pleura, within posterior mediastinum.

FIG. 19.



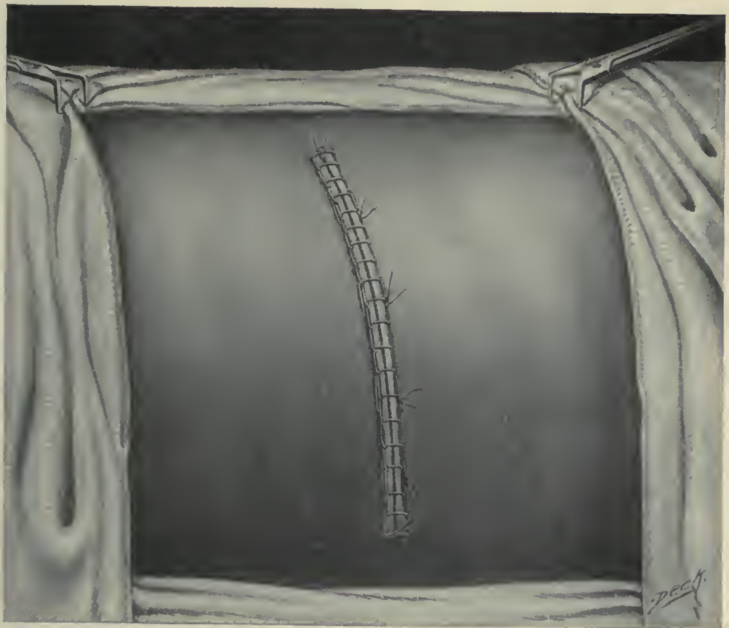
Placing pericostal silk sutures, avoiding intercostal arteries; left forefinger of surgeon raising lower intercostal space preparatory to introduction of needle at upper border of next rib below.

FIG. 20.



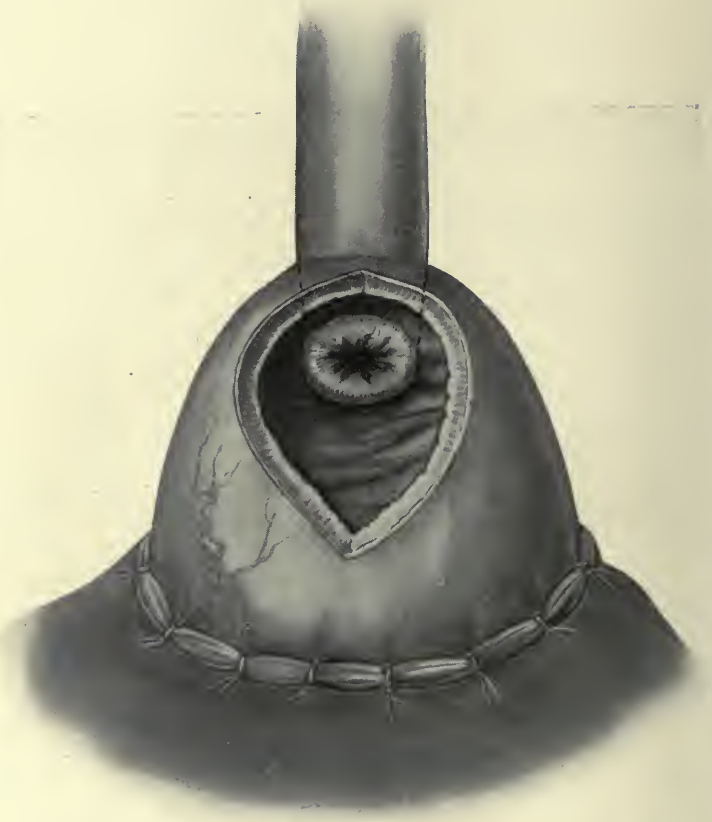
Pericostal sutures tied; first continuous catgut suture in place, uniting divided muscles and fasciæ; second suture under way.

FIG. 21.



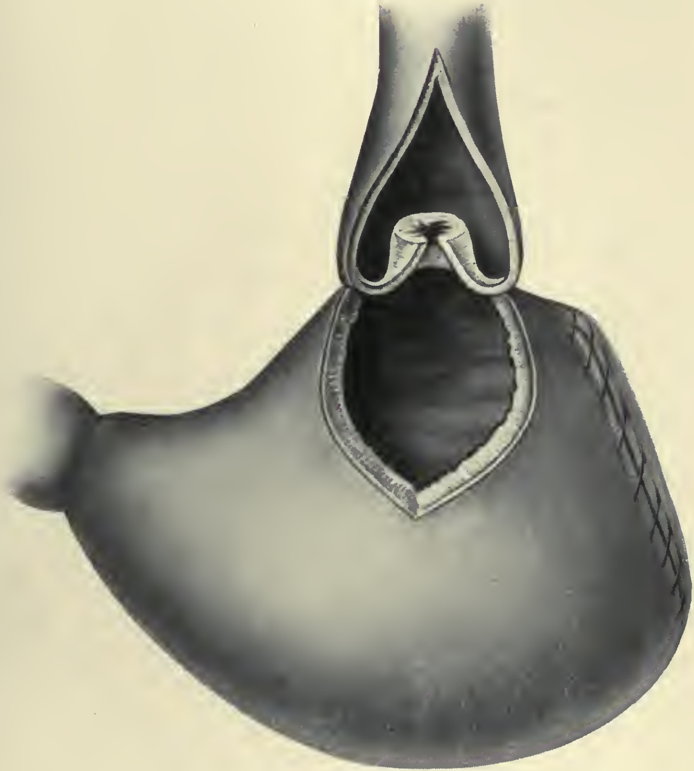
Skin wound closed with interrupted retention sutures and continuous interlocking catgut suture. Wound in eighth intercostal space, closed in the same manner, not shown.

FIG. 22.



Window cut in stomach wall, to show implanted end of œsophagus. (Drawn by artist, from specimen.)

Fig. 23.



Sketch, showing implanted end of œsophagus, which had been left unnecessarily long, as found inverted back into œsophagus, closing it tightly. (Drawn by artist, from specimen.)

forefinger into the abdominal cavity, receiving with the tip of his finger the tip of the needle. By thus guiding the tip of the needle he will be sure that no other tissue comes within the grasp of the needle (Fig. 7). Each suture, after having passed through diaphragm and gastric wall, is closed at once, its ends being left long and secured by forceps. Special care must be taken to do this work thoroughly. No space should remain, through which an abdominal organ might slip. If the distance between two sutures seems too long, additional, more superficial, intermittent sutures have to be placed. Every surgeon who has worked on dogs has a number of diaphragmatic herniæ to record that were found later on and frequently were the cause of death.

8. Diaphragmatic sutures cut short; tampon placed on intrathoracic portion of stomach; with surgeon's forefinger again surrounding œsophagus, a circular incision is made with the knife down to the fascial part of the tube (Fig. 8).

9. The muscular coat is pushed back and the inner layer (fascia plus mucosa), surrounded by a silk ligature, placed as tightly as possible and the œsophagus divided between this ligature and a clamp with Paquelin's cautery (Fig. 9).

10. The muscular coat is pulled over the divided end of the œsophagus by means of silk sutures (Fig. 10). If the muscular coat appears thick, a curved needle introduced parallel with the longitudinal axis of the œsophagus may be used; of course, it must not pierce the lumen. If the muscular layer be thin, a straight needle may be pushed at right angles to the longitudinal axis from right to left anteriorly and posteriorly, thus forming a mattress suture, for closure.

11. These sutures are tied, and the stump is dropped back, and a gauze tampon placed on top. The intrathoracic part of the stomach is raised, gently milking downward, and a curved long forceps with blades protected by rubber tubing, as used for gastro-enterostomy, is placed transversely around the stomach close to the diaphragm. Second intercostal incision in fifth interspace; œsophagus ligated with rapidly absorbable catgut (Levene),* making a single knot on either side, then securing the ends with a clamp; or making an ordinary double knot on one side only, with ends cut short,† a clamp placed distally;‡ division with scissors (Fig. 11). The cut end of the œsophagus is immediately mopped with lysol solution.

12. The stump of the divided œsophagus is drawn up by means of two forceps, with narrow tip and *without* mouse-teeth, best placed before

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* This catgut has been kindly prepared for me by Dr. Th. A. Levene of the Rockefeller Institute. It is boiled for five minutes in a solution consisting of 5 per cent. soap (potassium soap preferred) and 95 per cent. alcohol.

† In order to be able to feed the dogs as soon as possible and not to be obliged to wait for the absorption of this catgut thread, it was tried in two cases to close the proximal end by means of a bow-knot and, after implantation of the cut end of the œsophagus into the stomach, remove the bow-knot by simply pulling on one of its ends before the last anterior suture was closed. The observation made in two of these cases,

dividing the tube, and a narrow compress of moist gauze placed in the depth of the wound from right to left, same as we are wont to do in performing gastro-enterostomy; the wall of the stomach is stitched to the posterior wall of the œsophagus by means of a number (5–7) of silk sutures. The two placed at the extreme end are left long and secured by forceps; the others are cut short (Fig. 12).

13. Transverse incision through seromuscular coat of stomach in horizontal direction, three-fourths inch in front of these sutures. If the stomach appears to be thick, an ellipsoid excision of the two upper gastric layers may be made. The mucous membrane of the stomach is not yet divided. The upper lip of this wound nearest the œsophagus is stitched above the first layer of sutures to the œsophagus, securing further proper adaptation of the two organs to be anastomosed. They are cut short (Fig. 13).

14. The lower lip of stomach wound exclusive of mucosa and anterior wall of œsophagus caught by five silk sutures, but not tied as yet, the middle portion and the two ends of the thread being caught by an artery clamp (Fig. 14).

15. Three of these sutures are pushed to the left and two to the right, or vice versa, in order to expose the mucous membrane of the stomach, which is now incised transversely for about three-fourths inch with scissors or knife (Fig. 15). The gastric mucosa is mopped clean with a small piece of gauze soaked in lysol.

16. Œsophageal stump introduced into stomach. The five sutures placed before are now drawn tight, the middle one being the last (Fig. 16). The latter is tied immediately after the clamp which has introduced the œsophagus has been gently withdrawn. A number of additional sutures are placed to secure the proper implantation of the œsophagus into the stomach.

17. Second row of anterior sutures bringing into apposition the serosa of the stomach and part of the œsophagus further up (Fig. 17).

18. Tampons removed and œsophagus allowed to slip back into its normal position next to spinal column. The lower border of pleura is caught with forceps, pulled over the seat of the anastomosis and stitched to the stomach, thus hiding the suture line from view and placing the anastomosis into the posterior mediastinum (Fig. 18). Care must be taken not to enclose the loop of the nervi vagi.

19. Two to three pericostal silk sutures are placed around the two adjacent ribs; they are then drawn tight and cut short (Fig. 19).

20. The soft tissues of the chest wall are closed by continuous catgut suture, layer by layer (Fig. 20).

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that the œsophageal end within the stomach became inverted back into the tube, evidently in consequence of early vomiting spells and rapid agglutination of the muscularis, producing complete obstruction in this way, made me definitely abandon this otherwise simple and seemingly practical procedure. (See Fig. 23.)

‡ It is of importance to place this clamp over the ligature or just below the same *at once*. Observation was made repeatedly, that the air pressure from above distended the tube greatly and forced the ligature off.

21. Skin wound closed with 3 or 4 interrupted sutures, bringing the two sides in proper apposition. Continuous interlocking catgut sutures on top approximate the very edges of the skin wound.

The implantation, as it appears after completion of the operation, is illustrated by Fig. 22.

This kind of anastomosis was carried out in dogs eight times in all; after resection within the *lower third* of the œsophagus—this portion being supposed to be the seat of the disease—six times. Of this latter number three dogs died and three made an operative recovery. The causes of death were as follows:

One died within the first 12 hours after operation of secondary hemorrhage from a punctured diaphragmatic artery. One died 48 hours after operation of pneumothorax due to a tear in the lower lobe of the lung, which had been left unsutured, it having been produced by forcibly pulling the lung into the intercostal incision, when the belt of the pump slipped off the pulley and differential pressure was temporarily interrupted. (After that experiment a pump was substituted without a belt.) One died of septic pleuritic effusion with a well-functionating anastomosis, six days after operation.

Of the three that recovered of the operation, one is alive to-day, since February 23, and in excellent condition. One died on the tenth day after operation, having refused food; autopsy, probable slow necrosis of stomach. One died, also on the tenth day after operation, of distemper, this crux of surgical research work in dogs, with a well-functionating anastomosis.

To these six operations must be added two other cases in which the same kind of anastomosis was done, once in a resection of the cardia, and once in a resection of that portion of the œsophagus lying behind the aortic arch. In the case of resection of the cardia including about one-third of the cardiac end of the stomach, the dog recovered nicely from the operation, but died on the fourth day thereafter, having vomited all nourishment given. Autopsy showed the implanted lower end of the œsophagus inverted back into the tube, its muscular covering having become completely agglutinated

(Fig. 23). In this case a goodly portion of the œsophagus having been available for anastomosis, at least three-fourths of an inch of same had been implanted into the stomach. It is assumed that during one or more vomiting spells the implanted portion was pushed up into the lumen and became quickly adherent. A good lesson for the operator: First, not to allow the implanted portion to be too long; second, to introduce a bougie, if vomiting persists; third, to make use of Levene's rapidly absorbable catgut and allow the implanted portion to remain closed during the first few days after the operation, rather than to insist on making patent at once the lower cut end of the œsophagus by removing the bow-knot which closes it, before the last anterior suture is tied.

The dog in whom the part under the aortic arch had been resected, died of shock within 12 hours after operation. In this case almost the entire stomach had been pulled up into the thorax and anastomosis was then done in front of the aorta.

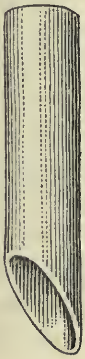
In addition to these eight operations which were done with the help of needle and thread I did two other cases of implantation of the divided œsophagus into the stomach on a somewhat different plan. In one an extramucous purse-string suture of silk had been placed around the implanted lower end of the divided œsophagus. This dog died on the sixth day after the operation, of distemper and gastric hemorrhage, the latter being due to a lead ball which had been attached to the cut end of the œsophagus and introduced into the stomach in order to pull it downward by its weight.

The second dog, which had made a perfect operative recovery, died suddenly on the twenty-third day after operation. At the time of this operation the method, described above, had not yet been thoroughly developed; the posterior approximating sutures, uniting the œsophageal stump to the stomach, had not been added as yet. Autopsy (Dr. F. C. Wood) showed a diaphragmatic hernia which had produced a kink in the duodenum; the stomach was filled with food. Direct mechanical pressure of the distended stomach upon the heart seemed to have been the immediate cause of death.

In view of the results obtained, the operation above described has to be considered a proper surgical procedure, technically. As to its functional results, ways will have to be found to avoid a stricture.

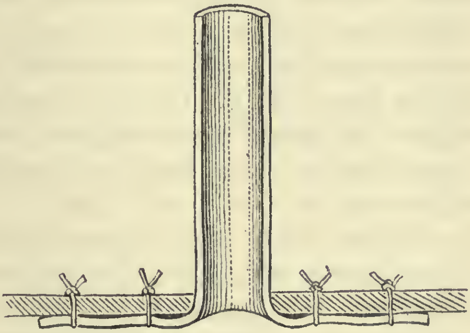
The latter must be due to one of the following causes: (1) To dividing the œsophagus with Paquelin's cautery, knowing that burnt wounds have a greater tendency to contraction than cut wounds. (2) To our dividing the œsophagus perpendicularly to its longitudinal axis, which also favors the formation of a stricture. (3) To contraction of the stomach wound around the implanted œsophagus.

FIG. 24.



Oblique division of œsophagus, to avoid stricture.

FIG. 25.



Œsophagus divided lengthwise, mattress sutures connecting its flaps with the cauterized gastric mucosa.

To avoid possibility No. 1, scissors were in later cases used instead of Paquelin's cautery in dividing the œsophagus. To overcome the second possibility, the œsophagus might be cut obliquely instead of transversely (Fig. 24), provided sufficient material be available at the proximal end (not yet tried), or, the lower end could be divided lengthwise and either half stitched to the gastric mucosa by means of a mattress suture or sutures, after the mucosa had been cauterized with Paquelin (Fig. 25).

This latter method has been tried, but the dog died of leakage and infectious pleurisy on the fourth day after operation (faulty technic, see above).

In order to simplify the operation, a purse-string suture, avoiding the gastric mucosa, of course, might be used, as done in the first dog operated upon with needle and thread. Post-mortem showed in that case, that the purse-string suture had slightly kinked the lower end of the œsophagus, it evidently having been drawn too tight. It is intended to try this method again and close the purse-string suture around a short cylindrical tube of magnesium, around which the lower end of the œsophagus is fastened by two circular ligatures. In this way the œsophagus cannot become strangulated by the purse-string suture and the magnesium will be absorbed. A few sutures may further secure the œsophagus to the stomach, as it is often done when using Murphy's button in abdominal surgery.

To avoid the third possibility, the gastric wall was not merely incised, but the seromuscular coat, according to thickness, either excised in an oval-shaped manner with the axis running parallel to the transverse diameter of the body, or pushed back with the handle of the knife or with Cooper's scissors and either border stitched on to the œsophagus, the gastric mucosa alone being last incised with a straight cut (see above).

We must try to render the operation less serious. Perhaps it may appear advisable in weak patients, to do a two-stage operation. For instance:

First stage: Thoracotomy in seventh or eighth intercostal space; transposition of part of stomach into thoracic cavity; loose fixation suture of stomach around rib, in order to keep the gastric wall on the stretch. Closure of thoracic wound. Jejunostomy for forced feeding. This latter operation could also be done prior to attacking the œsophagus. As the fistula is water-tight, the tube can be safely extracted for the time of operating on the thorax, the fistula can be packed with gauze and the external opening covered with zinc plaster. Leakage will not occur and infection be avoided.

Second stage, two to three weeks later, incision is made in the fifth intercostal space and œsophagogastrostomy done after resection of the growth.

We are justified in expecting this second act of the operation to be less dangerous as far as infection is concerned, than the first one. We know from our intra-abdominal work, that serous membranes, once opened and handled, absorb less and show greater resistance to infection than at the time of the primary interference.

Sauerbruch advises the use of Murphy's button for the anastomosis. I have tried this 8 times. One of the dogs was lost in consequence of pressure necrosis of the œsophagus by the border of the button about one-half of an inch above the anastomosis. After this experience I discarded the button, reserving its use for emergency cases, and have since then worked only with needle and thread.

At the Research Laboratory of the Medical Department of Columbia University of New York a special kind of small button has been brought out for this kind of work. Perhaps this would answer better than Murphy's cholecystenterostomy button which I tried. But the fact remains that in these cases, with a portion of the stomach pulled into the thoracic cavity, the button has to wander through the *entire* gastro-intestinal tract, inclusive of pylorus, duodenum and plica duodenojejunalis. The chances of its being retained are, therefore, much greater than in cases of gastroenterostomy or lateral intestinal anastomosis. There can be no question that, if œsophagogastrostomy *can* be safely accomplished with needle and thread, this method deserves the preference.

Of course, many roads lead to Rome. Nobody can be more fully aware than myself of the fact that the procedure just described is but one method that promises success. No doubt the combined work of many surgeons along the same lines and toward the same end will soon show us the right way; and, surely, such united effort is well worth undertaking. Are not thousands of patients dying every year of œsophageal carcinoma without our being able to offer them even a ray of hope from any kind of treatment. Ways and means *must* be found that will enable us to safely attack also this type of malignant growth if seen at an early stage of its development. We *must* succeed also in the human being in properly anastomosing the proximal end of the œsophagus to the stomach, so that the patient can again eat and drink in the normal manner.

CHRONIC INTESTINAL STASIS.*

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CHRONIC intestinal stasis comprises the conditions arising in consequence of the progressive development of an imperfect or delayed functioning of the gastro-intestinal tract. While constipation is the most frequent objective evidence of unsatisfactory drainage associated with chronic intestinal stasis, it happens not uncommonly that there may be a daily evacuation, though in some cases the motions may be abnormally frequent and loose. Therefore, the character and frequency of the evacuations are by no means constant in this condition. I will endeavor to describe what I consider to be its pathology.

1. In the first place, there is the dilatation and extension of the cæcum into the true pelvis, associated with the development of retaining bands or mesenteries between its outer aspect and the adjacent peritoneum lining the abdominal wall. The cæcum may become so distended that after occupying the true pelvis it ascends upwards from it.

2. There is the fixation of the appendix by retaining bands continuous with those holding up the cæcum and securing the appendix usually about its centre sometimes by separate bands and at other times by a band blended with the normal mesentery of the appendix. This band is continued by the proximal portion of the appendix, and forms together with it a retaining support helping to hold up the cæcum and oppose its descent from its normal position.

The drag exerted upon the cæcum, upon the proximal part of the appendix and upon its retaining band of peritoneum, produces a kinking of the lumen of the appendix at its point of fixation, since the distal portion of this structure is neces-

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sarily tilted abruptly upon its proximal segment. The degree and chronicity of this occlusion produce varying results, all of which are grouped under the heading of "appendicitis." The point of the abdominal wall to which the appendix becomes secured varies within wide limits, but it is usually anchored to the iliac fossa. If, however, it is fixed to the posterior wall or floor of the true pelvis, the appendix in the female finds itself in a dangerous proximity to the right ovary, which is affected by any inflammatory change in the appendix, while during menstruation the engorgement of the ovary and adjacent structures accentuates any trouble in the appendix.

Though surgeons refuse to recognize the causation of these bands obstructing the appendix, they know that adhesions exist about it very constantly, and they are always very ready to avail themselves of these adhesions as an excuse for removing the appendix when they have opened the abdomen on a wrong diagnosis of disease in some other organ, such as stone in the gall-bladder, duodenal ulcer, stone in the kidney or ureter, etc. At the operation, when the incorrectness of the diagnosis is plain to all they satisfy their own conscience, the medical attendant, the patient and friends, by removing an appendix anchored in the manner I have described.

3. The ascending colon is anchored to the peritoneum lining the abdominal wall external to it by similar bands while the hepatic flexure is drawn upward and outward to an abnormally high level by the presence of bands of peritoneum of considerable density.

4. The transverse colon forms a loop whose convexity reaches, in some cases, into the pelvis, where it struggles with the cæcum for priority of occupation.

Bands of peritoneum bind the convexity of the transverse colon to the adjacent ascending and descending segments of the colon. Above, these viscera are bound directly together by newly developed adhesions, but below they are connected by an acquired mesentery.

5. The splenic flexure and descending colon present changes similar to those described on the right side.

In the large bowel, generally, the strain exerted by restraining bands may so control it as to reduce its lumen very materially at one or more points.

6. The changes in the sigmoid are perhaps the most striking and obvious. They arise in precisely the same manner as those already described. Nature makes an effort to convert the mobile loop, which would attempt to occupy the pelvis, into a narrow fixed straight tube connecting the descending colon and rectum.

This is effected by the development of little bands which pick up the outer aspect of the mesosigmoid and secure it to the adjacent peritoneum. This process continues till a proportion of the outer wall of the sigmoid itself is secured to the iliac fossa and the tube is rendered fixed and straight, all evidence of the original loop having disappeared. This ideal condition does not always exist since the bulk of the mesentery may not have been grasped securely by the newly developed adhesions before the ends of the loop have been secured and approximated by them. Consequently, a very considerable dilatation of the sigmoid results, and when it is completely obstructed it is called a volvulus.

The fixation of the sigmoid by these acquired adhesions may be irregular, and obstruction may occur at one or more points in its length.

Unfortunately for the left ovary, it lies in immediate relationship with the mesosigmoid, and it very frequently indeed becomes involved and fixed in the acquired adhesions. In some cases it appears as if the ovary is merely anchored to the contracting mesosigmoid by adhesions, while in others the ovary may be completely surrounded by and included in the altered mesosigmoid.

7. The fixation of the left ovary is very detrimental to that structure since it is followed sooner or later by a cystic change in that organ. In some cases the ovary may be infected with a chronic inflammation, or suppuration may result in it, necessitating its removal. Very rarely the sigmoid may be so much involved by the process that it may be necessary to resect a portion of it also.

The cystic ovary, completely surrounded by the adhesions, may, after a time, again become mobile in a cavity developed in them, and later may escape from it. It then ceases to have any apparent connection with the adhesions in which it was embedded except in so far as the association of an anchored sigmoid and a cystic ovary is observed to exist.

8. The ileum is very thin walled and flaccid. If its termination is drawn upward so as to expose the under surface of its mesentery the peritoneum forming its posterior surface is picked up in puckers, precisely like the mesosigmoid but not so effectually. This is clearly with the object of helping to support the loaded cæcum and oppose its displacement.

9. The stomach is dragged downward by the pull exerted upon its convexity by the depressed transverse colon, while the pylorus and first portion of the duodenum are bound to the under surface of the liver and often to the cystic duct and gall-bladder. The stomach is dilated, apparently because of the kink effected at the exit by the downward drag on the convexity of the stomach and the resistance offered by the adhesions binding the pylorus and duodenum to the liver.

Owing to the very different construction and mechanics of the abdomen and of the viscera in the sexes, the mode of anchoring of the pylorus and duodenum differs somewhat. I believe that this variation is responsible for the greater frequency of duodenal ulcer in the male and of gastric ulcer in the female.

The posterior surface of the stomach is not infrequently adherent to the peritoneum covering the pancreas, etc.

10. The gall-bladder is generally full of bile, and gall-stones are not infrequently present. The development of gall-stones may be consequent on the stagnation of bile in the gall-bladder whose evacuation is impaired by the drag upon it or its duct by the anchored duodenum and pylorus and by the prolapse of the liver itself. Women being much more frequently affected by intestinal stasis than men, suffer more often from gall-stones. It is a noteworthy fact, that while

gall-stones do not form in cases of intestinal stasis in which loss of flesh results at an early period of life from toxic absorption, they do so very readily in stout women, in whom intestinal stasis develops in a marked degree comparatively late in life.

11. The breasts show changes which vary from a recurring mastitis affecting the upper and outer segments of the breasts, and especially of the left, to a definite cystic degeneration involving the whole of both breasts. These degenerated breasts are very susceptible to the development of malignant disease.

12. The kidneys are mobile.

13. There is very little fat.

14. The skin is stained and inelastic.

15. Respiration is chiefly diaphragmatic.

16. The circulation is bad, as evidenced by the coldness of the extremities.

17. The muscles are very friable and small in bulk.

Symptoms.—The symptoms produced by this condition of things are due in part to the interference in the normal functioning, and are expressed by pain, and in part to the absorption of poisonous material, and are evidenced as toxæmia.

While toxic symptoms may exist without pain, pain has always associated with it definite evidence of auto-intoxication. I would just mention that many of the objective evidences of auto-intoxication, such as pigmentation of the skin and bad smelling perspiration, are much influenced by the color of the hair. In light-haired people a very advanced condition of poisoning may exist without the presence of these symptoms, while in dark-haired people these evidences appear at an early period.

Pain is due apparently to the distention of a portion of the bowel with fecal contents and their gaseous products, or by the passage of fecal material through the bowel. For instance, the distention of the cæcum is a frequent and distressing symptom.

Pain about the hepatic and splenic flexures, both in front and behind, results from the obstruction which exists at those points and from the drag or strain upon the retaining bands by the loaded bowel in the erect posture of the trunk.

Pain in the sigmoid segment may be due to the difficulty in forcing the contents through a fixed straight tube of diminished calibre, length, and elasticity, whose mucous membrane may be gorged, inflamed or even ulcerated, or to the distention of a loop or loops placed at a mechanical disadvantage by irregular anchoring by adhesions. Pain also results from the distention of the stomach, and also of the small bowel because of its delayed functioning.

Pain in the fixed left ovary is frequently a distressing symptom, especially at the periods. The fixation of this irritated organ renders it very tender on pressure, especially if examined bimanually, since it cannot readily avoid the pressure of the fingers as a mobile ovary does. Apart from this, there are the mechanical symptoms which ensue from the progressive development of the cystic condition of the ovary which is now found to be more frequently malignant in structure than was supposed.

Degenerative cystic changes in the breast are very commonly present in a varying degree in certain cases of chronic intestinal stasis. This change is usually first observed in the upper and outer segment of the left breast, and later in the corresponding area of the right breast.

In the young unmarried woman a chronic mastitis which is accentuated at the periods is a very common symptom. It affects the same areas of the breasts as does the cystic change which appears later. In a number of patients on whom I have operated for chronic intestinal stasis, one or both breasts had been removed for cystic degeneration. This condition has been called Schimmelbusch's disease. I have been much struck by the fact that these degenerative conditions do not arise in the breasts of women having regular intercourse, however toxic they may be, while they develop very rapidly on its cessation. How far the mechanical impairment of the sexual apparatus here referred to is responsible for the loss of sexual appetite, which is a very marked feature in these women, and how far it is consequent on the associated toxæmia, is a matter of question. In any case it is much influenced for good by the cessation of the auto-intoxication following on some satisfactory treatment of the defective intestinal drainage. It is not improbable that the more frequent presence of cystic change in the left breast results from the fact that the left ovary is damaged and rendered cystic very much more often than the right, owing to its fixation by or inclusion in the bands which obliterate the mesosigmoid and shorten and straighten the sigmoid.

The pain due to movable kidneys, gall-stones, gastric and duodenal ulcers, pancreatitis, renal conditions due to the narrowing of the right ureter by the band retaining the appendix or by suppuration about the appendix, uterine versions and flexions, and to many other conditions which I believe are all effects of chronic intestinal stasis, is fairly characteristic. It is difficult to separate abruptly the symptoms that are brought about mechanically by intestinal stasis from those which result from the consequent auto-intoxication, since many are due to both.

Here I would like to call attention particularly to the work of Dr. Victor Vaughan and Miss Wheeler "On the Effects of Egg White and Its Split Products on Animals," and the work of Dr. Turck "On Experimental Studies on Round Ulcer of the Stomach and Duodenum." I can do no more than refer to them here, but their importance in reference to intestinal stasis is obviously very great indeed.

The chief toxic symptoms are: Headache, a feeling of mental and physical lassitude, an inability to perform the ordinary duties of life, mental misery and distress, nerve symptoms (as migraine, etc.), which are comprised usually under the term of biliousness, and a want of control over the temper which renders these patients unpleasant and unhappy companions.

The symptoms for which the patient seeks relief from the surgeon vary materially with the position and occupation of the sufferer. While the unfortunate governess or domestic servant will struggle on until complete physical disability renders her incapable of performing her duties, the woman who has not to earn her living calls attention rather to the mental distress from which she suffers. For this reason the patient in good circumstances receives attention at a much earlier stage in the disease than does the poor worker and either requires a less extensive operation or benefits much more from a serious one. Too frequently the poorer patient has reached a stage in which operative procedures, however extensive, afford only a temporary benefit, since the distention of the small intestine having reached a certain limit is liable to return and progress after an interval, and with this distention is associated pain for which very little relief can be afforded.

Of the many cases of chronic intestinal stasis in private practice which called for operative interference, in nine only have I removed the large bowel. Of these one died, and that accidentally from the bursting of a small deep-seated stitch abscess into the general cavity. Of the larger number of private cases in which division of the ileum and its junction with the large bowel was effected, there was no death from the operation. One of these patients died from acute obstruction six months after the operation. The cases in private practice in which simple division of constricting bands or the establishment of a junction between the occluded ileum and the sigmoid or rectum are sufficient, are much more commonly met with than in hospital practice.

Auto-intoxication reduces the resisting power of the individual to the entry of organisms of various sorts, and facilitates their obtaining a foothold in some of the tissues of the body. I will call attention to only one organism—namely, the tubercle bacillus, since it illustrates very well this depreciation in the vitality of the tissues. The examination of a large number of dark-haired children affected with chronic tubercular disease of joints will show the presence in them of unmistakable signs of auto-intoxication.

The examination of a number of girls suffering from lateral curvature or the fixation of the asymmetrical position of rest will afford striking evidence of the effect of the toxin in depreciating the respiratory capacity and energy of the individual, and will show them to be characteristically toxic. In them, as in the tubercular cases alluded to, thoracic respiration is more or less completely in abeyance.

TREATMENT.

If I have done no more than to impress on the reader the importance of regarding chronic intestinal stasis as a very serious condition, and one whose capacity for harm is great and far-reaching in its results, I shall feel that my efforts have not been without result. We must acquire as thorough a knowledge as possible of the causation and pathology of delayed intestinal drainage, and so endeavor to render our treatment of its several stages as scientific as possible.

I do not propose to discuss the medical treatment here, but will assume that the condition has developed to a degree that such treatment is obviously inefficacious to give the relief required. In other words, a stage has been reached in which, owing to the delay in evacuating its contents, the large bowel has not only ceased to perform a useful function but has become such a source of danger that its removal from the drainage scheme will be of great service to the body.

It depends on the development of the condition as to whether it is sufficient to separate and destroy constricting bands, or to divide the ileum and to connect it with the sigmoid or rectum, or whether it is necessary to remove the large bowel proximal to the junction. While in an early stage, and especially in the male subject, the obstruction at the hepatic or splenic flexures or at the sigmoid may be relieved by the division of bands producing constriction, in a late stage when the small intestine has undergone extreme changes the removal of the whole of the large bowel proximal to a junction between the small intestine and the sigmoid affords only a temporary alleviation of symptoms.

The most favorable cases for operation are those in which the symptoms are of a toxic rather than of a painful nature. In such, the division of the ileum and its junction with the lower part of the large bowel gives complete relief to the symptoms, and the consequent physical and mental improvement is extraordinary. When painful symptoms are much in evidence the large bowel should be removed. The risk entailed by operation can be reduced very materially by first relieving the toxic symptoms by connecting the divided ileum with the sigmoid or rectum, and later, when the general condition of the patient has improved in consequence of this procedure, the large bowel can be excised if the symptoms demand it. I do not pretend that removal of the large bowel is not a very serious operation in certain circumstances. Indeed, in many of these patients any serious operation must be regarded as being dangerous to life, the danger varying chiefly with the degree of toxicity. I may say that in these and similar cases the risk can be very greatly diminished by the subcutaneous injection of a large quantity of normal saline solution immediately before the operation. By this means the patient appears to suffer a minimum of shock from the extensive operative procedure, and vomiting either does not follow it or, should it do so, is trivial in character. In these cases the absence of vomiting is a matter of very great importance. It was very frequent and severe after my earlier excisions of the large intestine, and was the cause of more than one fatal result. Besides the distress and depressing influence it exerted on the patient, the constantly recurring strain on a long wound was very liable to render it insecure or to determine the development of a septic infection in it which would probably not have occurred had the recently incised structures been kept at rest. The risk of an infection starting in the peritoneal cavity appears to be very small. The mode in which the subcutaneous transfusion of normal saline employed immediately before the operation acts, has been very clearly demonstrated by Dr. Crile's most interesting and valuable researches on the production of shock, of which America must be very justly proud.

SURGERY OF THE LARGE INTESTINE.*

WITH A REVIEW OF ONE HUNDRED RESECTIONS.

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I. GENERAL CONSIDERATIONS.

From the foregut we get the stomach and duodenum to a point below the common duct, the liver and the pancreas. All of these organs derive their nourishment from the cœliac axis and are concerned in the preparation of food for absorption but do not themselves absorb. Morphologically the small intestine begins at the pylorus, functionally at a point beyond the common duct.

The derivatives of the midgut are concerned in absorption and assimilation, and extend from the middle of the duodenum to the splenic flexure of the colon, where the hindgut begins and corresponds to the area of distribution of the superior mesenteric artery.

Ninety per cent. of the solids are picked up in the jejunum and ileum, and about half of the fluids are absorbed there. Ten per cent. of the solids and the balance of the fluids are absorbed in the large intestine proximal to the splenic flexure, largely in the cæcum. A physiological contraction between the cæcum and ascending colon at the situation of the cæcocolic sphincter in certain lower animals, holds the material between this point and the ileocæcal valves during absorption, and accounts for the localized cæcal distention with gas and fluids noticeable on palpation in diarrhœal disturbances. The fluids ingested, and also those secreted by the liver and pancreas, are used to keep the ingesta thin and in close contact with the valvulæ conniventes and to mechanically float the residue finally into the cæcum, where fluidity is no longer necessary and where it is re-absorbed. The chemical change from alkalinity to acidity of the material upon entering the large intestine, a change which is connected with bacterial action, causes the formation of gases which play an important part in the further progress of the residue in the large intestine.

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* Read before the American Surgical Association, June 5, 1909.

The differentiation between the midgut and the hindgut is not so well marked as between the foregut and the midgut (Young-Robinson). The hindgut gives rise to the descending colon, the sigmoid and rectum to the anal canal, and is supplied by the inferior mesenteric artery. Excepting during defecation the normal intestinal movement in this portion of the intestinal tract is antiperistaltic, so that fluids introduced into the rectum, as in Murphy's proctoclysis, are carried backward for absorption above the splenic flexure, only a small amount being taken up by the derivatives of the hindgut, although many drugs and chemicals may be absorbed here. Bond has shown that solid particles when placed in the rectum are also carried upward by what he calls "reverse mucous currents." The descending colon, which marks the beginning of the hindgut, is usually found empty and acts as a passageway between the physiologically active midgut and the passive sigmoid. The function of the latter is to act as a fecal container, which its trap-like curves enable it to do.

At the juncture of the fundus and the antrum of the stomach there is a physiological muscular activity which takes the place of the antral sphincter in certain of the lower animals. From this point to the descending colon the control depends upon internal secretions, and the sympathetic ganglia, and, while influenced by Auerbach's and Meissner's plexuses, this control is largely independent of the cerebrospinal nervous system, as the maintenance of the body is a primitive function and existed before the development of the cerebrospinal system.

In the eleventh week of fetal existence the large intestine shows the cæcal bud beginning to contract at its extremity, the site of the future appendix. The intestinal tube, which has been straight, has developed the U-shaped loop connected with the yolk-sac by the vitelline duct close to its middle. The remains of this duct may give rise to a Meckel's diverticulum which, if present, is usually to be found in the lower ileum within two or three feet of the ileocæcal valve. At the third month the entire large intestine is still to the left of the median line; but by the fourth month the head of the colon has rotated across the superior mesenteric artery and duodenum, and lies underneath the liver, to reach its normal situation soon after birth. During this rotation the contraction of the large herbivorous-like cæcum into the carnivorous type is rapid, and the appendix is one result. Failure of complete rotation of the large intestine accounts for those cases of appendicitis on the left side or under the liver.

According to Ribbert, at birth the appendix is one-tenth the length of the large intestine, and in the adult, one-twentieth. Birmingham gives the length as one-sixteenth at birth and one-twentieth in the adult. Up to six years of age the normal appendix always contains a lumen, but after this time there often begins an involution with obliteration of the lumen from the tip toward the base. Ribbert states that in adults thirty-five years of age 25 per cent. of appendices are completely obliterated, and at seventy years of age one-half or more are obliterated. Birmingham's investigations do not bear out Ribbert's claims. He states that only 3 to 4 per cent. of adults have completely obliterated appendices, but that 25 per cent. of young adults and 50 per cent. at the age of fifty show partial obliteration. Our observations agree with those made by Birmingham.

Irregular obliteration, producing dams and strictures along the lumen of the appendix, is undoubtedly an important factor in the sedimentation which produces those fecal concretions which play so important a rôle in the causation of appendicitis.

Berry believes that the appendix is an important organ containing lymphoid structures like Peyer's patches, and that the tendency to obliteration seen in adults is the normal atrophy of lymph organs which occurs after the growing period of the individual has been accomplished.

Macewen and Keetley deprecate the present tendency to remove the appendix unless absolutely necessary to save life, believing that its removal tends to cause constipation and other colonic diseases. Keetley goes so far as to advocate the practice of opening up the appendix, removing stones if they are present, evacuating abscesses and finally burying the remnant of the organ in the abdominal wall to prevent future chance of peritonitis, thinking thus not only to maintain the function of the appendix but to enable its later use for appendicostomy should colonic inflammation or obstinate constipation supervene. I am unable to concur in this opinion as I cannot believe that an organ of such exceptional value as they state the appendix to be would so early become atrophied were it endowed with so great a function. At best, the saving of a functionally useless organ which is so diseased as to contain abscesses, stones, etc., is not in harmony with modern views. We are only just beginning to recognize that serious functional digestive disturbances, such as pyloric spasm (appendiceal dyspepsia), colitis, etc., are often produced by a chronically diseased appendix.

It is evident that constipation most directly concerns the sigmoid and that its function as a fecal container is a comparatively late evolution. This is shown by the great variations in its length, size and shape (Finney). The fact that the sigmoid, like the fundus of the stomach, is more or less under conscious control of the cerebrospinal nervous system, also indicates a late development.

In the ANNALS OF SURGERY, December, 1900, the writer calls attention to certain varieties of constipation having primary origin in the small intestine due to congenital or acquired narrowing at the ileocæcal orifice, and reported several cases relieved by operation. Further experience has strengthened the opinion therein expressed. An obstinate constipation may depend upon too prolonged retention of the ingesta in the small intestine, interfering with proper chemical changes.

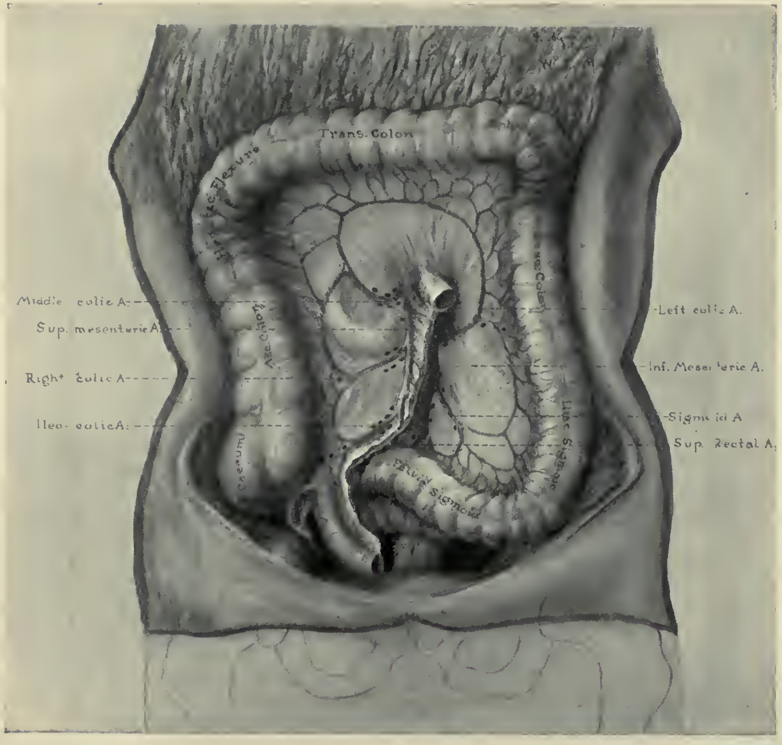
The head of the colon is extensively sacculated and of large capacity, but gradually diminishes in size, and in the descending colon and sigmoid the sacculations are primitive (Fig. 1). The diameter of the sigmoid is less than one-half that of the cæcum. The longitudinal bands of muscle have, however, gradually increased in width and strength until at the juncture of the sigmoid and rectum they practically surround the intestine and a complete investment extends down about the rectum, showing the increased muscular pressure which is necessary to propel non-liquid contents. Defecation is accomplished largely by siphonage which usually completely empties the sigmoid. A hardened mass of fæces forms the apex of the stool-mass which is set in motion by the abdominal muscles compressing the intestinal gases. The normal rectum in the quiescent state contains fæces only temporarily, as is shown by the examination of a large number of males for the army service. In the female, and sometimes in the male, an acquired tolerance may be found, and the rectum to contain chronically more or less hardened fæces.

Treves in 1885 and Jonnesco in 1889 called attention to the inaccuracy of the anatomical description of the lowest sigmoid and first portion of the rectum, showing correctly, as I believe, that the so-called "first portion of the rectum" should be considered the terminal portion of the sigmoid down to the ending of the mesenteric attachment at about the third sacral vertebra. Here the rectum begins and extends to the anal canal which lies below the levator-ani muscle. Embryologically, the true rectum has its origin from the highly differentiated lower part of the hindgut called the *cloaca,* which forms the bladder and rectum. This primitive association is of importance in the study of malignant disease.

Symington has made careful studies of the lower rectum and points out that the anal canal, about one to one and one-fourth inches in length, is completely invested with muscle and has its origin in the proctodeum, and for this reason in cancer of this locality the inguinal glands are liable to be involved as well as the perirectal.

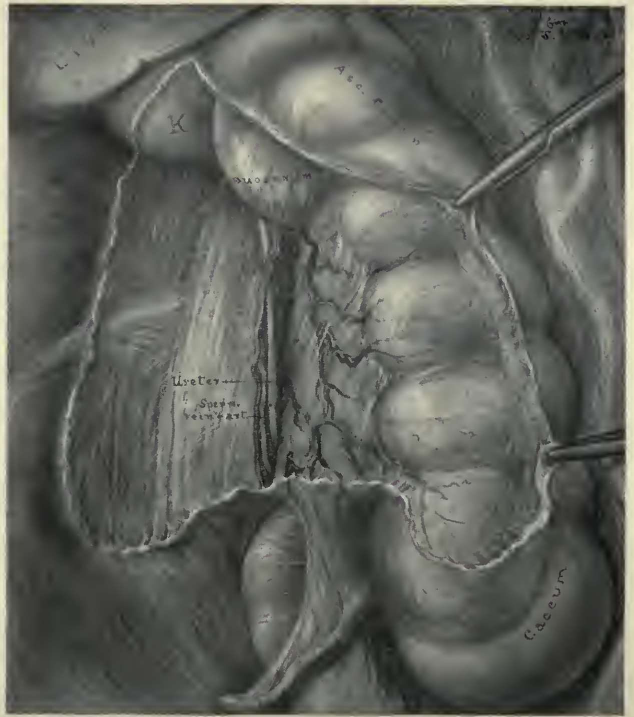
British anatomists divide the sigmoid into two portions. First, the iliac, 5 to 6 inches in length, extending from the

FIG. 1.



Anatomy of the large intestine. Note the relation of glands and blood-vessels.

FIG. 2



Mobilization of cæcum and ascending colon. Note duodenum and ureter exposed.

descending colon to brim of the true pelvis and having, if any, a very limited mesentery. Second, the pelvic portion, which averages 16 to 18 inches in length, has a long mesentery and loops across the median line. Cunningham states that in 92 per cent. of subjects the pelvic sigmoid lies in the true pelvis after death. There is no question but that this description is more accurate and is based on a better understanding of the anatomy than that which is ordinarily accepted in this country (Fig. 1).

The large intestine is from 5 to 5½ feet in length, and is about one-fifth of the intestinal tract.

The cæcum and appendix are ordinarily completely invested by peritoneum. The transverse colon, which, including the hepatic and splenic flexure, is about 20 inches in length, and the pelvic sigmoid, have a well developed mesentery. The ascending and descending colon, and the iliac sigmoid are more or less closely attached to the posteriolateral parietes.

The ascending colon, averaging from 7 to 8 inches in length, has an insecure attachment to the posterior muscles in its retroperitoneal extent, and upon this the weight of the ileocæcal coil is suspended. The result of the traction tends to loosen the ascending colon from its bed, leaving a pouch into which the right kidney often prolapses, the descent of the kidney being aided by the attachment of the colon to Garroto's capsule and the so-called "nephrocolic ligament." On the left side this does not obtain, as the descending colon and the iliac sigmoid is closely attached in its retroperitoneal extent and gives a weight-bearing space of from 12 to 14 inches.

Under normal conditions, as shown by Monks, the lowest ileum lies in the pelvis, the last 8 inches ascending from the pelvis to the cæcum, and its terminal 2 inches is closely attached on the cæcal side (Fig. 4). This attachment takes place early in fetal existence so that, as a rule, the base of the appendix will be found within three-fourths of an inch of the ileocæcal orifice. The lop-sided appearance of the cæcum is due to the development of sacculations, which more easily occur on the free side. The terminal 6 inches of the ileum has the same blood supply and lymph drainage as the cæcum, through the ileocæcal vessels. For this reason, in all cases of malignant diseases of the cæcum, the appendix and terminal 6 inches of the ileum must be removed. Occasionally a lymph gland will lie in the meso-appendix, and if so, lymph drainage from the right ovary and tube may find its way into it through Cleido's ligament.

The ascending colon is supplied by the right colic artery, a branch of the superior mesenteric, anastomosing below with the ileocolic and above with the branches of the middle colic. The lymphatic drainage extends into the lymphatic glands at the base of the right colic artery and also in the ileocolic group. In carcinoma of the ascending colon it is necessary to remove the cæcum and the terminal 6 inches of the ileum in order to secure the tributary lymph nodes.

The middle colic artery comes from the superior mesenteric just below the pancreas, passing almost directly downward into the transverse mesocolon where it gives off large arterial arches to the right and left. The main arch passes to the left to anastomose with the left colic which arises from the inferior mesenteric. The middle colic is the main source of the blood supply of the transverse colon, including the hepatic and splenic flexures, and while the anastomoses with the right and left colic suffice for the hepatic and splenic flexures respectively, Krönlein points out that in four cases out of five the transverse colon itself will not be nourished in its whole extent if the middle colic vessels are ligated. Injury to this vessel sometimes happens in resection of the stomach for cancer and may cause gangrene of the transverse colon.

The splenic flexure of the colon has a reduplication of the peritoneum derived embryologically from the omentum, which is sufficiently defined to be called the "costocolic ligament." The costocolic ligament has no large blood vessels, and by division of it the splenic flexure is loosened from its deep situation and can be readily brought to the surface. The hepatic flexure has not this source of retention, therefore it is easily accessible, although there is often an extension to it of the duodenohepatic ligament.

The lymph drainage of the hepatic and splenic flexures as well as the transverse colon follows into the root of the transverse mesocolon. The lymph nodes are in close communication with the deep lymph-chain along the aorta and about the head of the pancreas, and in malignant disease the accurate removal of the lymphatic-bearing mesentery is correspondingly difficult.

The left colic artery supplies the descending colon, but its anastomosis with the middle colic above and the sigmoid below makes extensive resections in this vicinity relatively safe. Fortunately the lymph supply diminishes rapidly from the ileocæcal coil, and has reached its lowest ebb in the sigmoid. The very nature of the function of the colon, containing as it does virulent bacteria and toxic poisons, makes this lymph sparseness a necessity. Butlin has shown that over 60 per cent. of the deaths from cancer of the colon take place from obstruction or other causes before there is general metastasis, and many times, if enlarged glands are present, they will be found inflammatory.

The tendency of the lymph drainage of the descending colon is towards the transverse mesocolon following the middle colic tributaries.

The sigmoid derives its blood supply from the sigmoid artery, a branch of the inferior mesenteric, and anastomoses freely above with the left colic, and below with the superior rectal. The lymph drainage follows the vessels, and Moynihan points out that the highest lymph node lies at the origin of the inferior mesenteric vessel. It would appear necessary, therefore, in operating for carcinoma of the sigmoid to resect extensively so as to remove the Moynihan gland with the mesentery, although this may necessitate destruction of the inferior mesenteric vessel with its tributary intestine.

The terminal portion of the sigmoid, the so-called "first portion of the rectum," is supplied by the superior rectal artery which communicates freely with the middle hæmorrhoidal arteries. The lymph drainage follows the superior rectal vessel which is the direct continuation of the inferior mesenteric, and to secure the highest lymph node at the origin of the inferior mesenteric, it may become necessary to ligate this vessel and remove the devitalized colon possibly almost to the splenic flexure.

In estimating the feasibility of removing malignant disease of the large intestine, the examination of the liver for embolic carcinoma should not be forgotten. In our experience, hepatic secondaries have been a larger cause of contra-indication to radical operation in mechanically removable tumors than inoperable glandular metastasis.

By rectal touch the peritoneal sac can be felt anteriorly at the rectovesical fold. Carcinoma of any viscus in the peritoneal cavity may permit detachment of carcinoma cells which gravitate into the cul-de-sac and graft upon the adjacent sigmoid, giving rise to the characteristic nodules which indicate the nature of the primary and possibly unlocated disease.

There are a number of fossæ in connection with the large intestine which may occasionally have surgical importance. They are due to faulty blending of the peritoneum with the large intestine, giving rise to small pockets extending up behind the bowel. There are several of these recesses about the cæcum in which the appendix is occasionally found.

This faulty blending of the large intestine with the peritoneum is well shown on the right side, the peritoneal sac being well developed before the cæcum and ascending colon reaches its normal position, which does not occur until at or near birth. The result is that the attachment of the head of the colon to the parietal peritoneum is of a veil-like nature, resembling adhesions.

The entire large intestine is covered with a greater or less number of appendices epiploicæ, and in the obese these epiploic tags may reach considerable size. As a result of injury or local peritonitis they sometimes become attached to the parietes or neighboring structures, causing fixation of the intestine, or a band may be the cause of obstruction. Torsion may occur, with necrosis. We have met with two examples of this condition.

II.—SURGICAL CONSIDERATIONS.

Preparation.—Perhaps no factor has proved of greater importance to the human race than the sterilization of food by cooking. While the secretions of the stomach itself outside of the stomach do not have marked bactericidal properties, it should not be forgotten that bacteria are vegetable organisms, and that the digestive power of the stomach acts to destroy the bulk of the micro-organisms introduced so that the contents of the duodenum and upper jejunum, as shown by Adami and Cushing, are relatively sterile. This is shown clinically by the higher percentage of recoveries from perforations, gunshot injuries, etc., in the stomach, duodenum and jejunum, as contrasted with the ileum and colon.

The ileum contains a rapidly increasing number of bacteria and the lower two feet teem with virulent organisms. In the colon bacterial growth is marked and adds materially to the bulk of the stool. Hochenegg points out that liquid stool contains very active bacteria, especially the colon type, and therefore catharsis should not immediately precede operation upon the colon. The bowel should be thoroughly emptied 48 hours preceding operation, giving at least 24 hours for the intestine to become quiet. This is also advisable because of the greater ease of dealing mechanically with the bowel if its contents are semi-solid rather than fluid.

Obstruction.—The most important feature of surgery of the large intestine, taken as a whole, is the question of obstruction. The mortality of necessary operations can be closely measured by the degree and acuteness of this condition.

It happens, unfortunately, that in some cases of tumor the first important symptom is an attack of acute obstruction. This is particularly true of tumors of the sigmoid where the calibre of the intestine is more limited and the contents of a more solid nature. The obstruction interferes with the vitality of the distended intestine, renders it difficult to obtain proper asepsis during operation, and if resection is decided upon there may be considerable trouble in uniting the distended to the collapsed segment of bowel. If the condition is acute the absorbed toxins depress the heart's action and the abdominal distention interferes with the action of the diaphragm; if chronic the interference with the progress of the food causes indigestion, nausea, gas and abdominal distention. In suspected tumors of the large intestine careful examination should be made to arrive at a diagnosis before the stage of obstruction is reached. In the majority of instances the patient will have had symptoms upon which an early diagnosis of beginning obstruction can be made. There is, first, irregular bowel action, alternating constipation and diarrhœa with an unsatisfied feeling after stool; the movement failing to give complete relief. Second, cramps in the abdomen attended by borborygmus, and *the patient will nearly always be able to locate the site of obstruction* as it will be found at the point where the internal pressure is most intense. Third, on palpation the peculiar localized stiffening of the intestinal wall on the proximal side of the structure gives a "tumor-like feel" to the examining fingers which appears and disappears and is usually accompanied by gurgling of fluids and gases at the point of obstruction. Complete relaxation without anæsthesia can usually be obtained in the hot-water bath and a tumor, if present, can be detected. In low-lying tumors the sigmoidoscope may reach the growth. Several times I have found a sigmoid tumor prolapsed into the rectum following a large soapy water enemata, so that it could be felt with the examining finger.

The danger of drowning from the regurgitation of intestinal contents during anæsthesia should not be forgotten, and every case of obstruction should have the stomach emptied previous to operation. As a matter of fact, by careful attention to emptying the stomach and the use of saline enematas, a great many patients can be tided through a serious attack of obstruction, and the operation performed later under more favorable conditions.

The Incision.—In proposed resection of the large intestine the incision should be placed to the inner side of the seat of the disease. If the diagnosis has not been established it is best to make a median incision through which the hand can be used to explore the abdomen. A second working incision can then be made at the most convenient situation. The utmost care must be taken to prevent infection from intestinal contents. If the proximal gut is greatly distended it will be best to make a temporary incision into it at a point where the mesocolon is sufficiently long to allow its being drawn well out of the abdomen, and with a tube empty the contained material after the method of Monks. Treves states that emptying the distended intestine at a point above the obstruction has reduced the mortality of operations one half, in acute conditions.

Mobilization.—The most important technical feature is mobilization of the large intestine for purposes of operation. The large intestine has a very long mesentery because all of its blood, nerve and lymph supply lies in the inner leaf of the mesentery and arises from the abdominal aorta and vena cava or in that vicinity. It is true that the outer leaf of the mesentery is exceedingly short, if not absent, in the ascending and descending colon and iliac sigmoid; but as the outer leaf contains no structures of importance it is only necessary to divide it, lift the colon from its bed and swing it on its inner leaf to the midline. Therefore, the *sine qua non* for efficient operation is to locate the lesion, divide the peritoneal reflection to the abdominal wall, which mobilizes the part and allows it to be completely drawn outside of the abdomen where it can be adequately surrounded with aseptic pads for clean work. By holding the color up to the light the blood vessels can be identified in the inner leaf of the mesentery, and caught, tied and divided. Mr. Moynihan shows that in this way even the descending colon may be mobilized so that it can be anastomosed with the rectum or even brought down to the sphincter muscles. The transverse colon can be readily mobilized by dividing the gastrocolic omentum.

In separating the colon and ligating the blood vessels there are some structures that must be identified.

First, the *duodenum,* a portion of which is bared in making a proper exposure of the ascending colon and the hepatic flexure. For this reason great pains should be used in the ligation of the right colic and right branches of the middle colic vessels so the duodenum will not be injured or caught in the teeth of the forceps during operation (Fig. 2).

Second, the *ureters* must be identified and separated from adherent growths of the ileocæcal coil and ascending colon on the right side, on the left from the descending colon, and especially from the sigmoid. It must not be forgotten that just after the ureters cross the common iliac vessels they are adherent to the peritoneum and that as the colon is mobilized and pushed toward the median line the ureters go with it. Almost invariably the left ureter will be carried with the sigmoid and should be identified and separated before the resection is commenced (Fig. 2).

Third, the vasa deferentia are closely associated with the lowest sigmoid and rectum and while not so important, they should be protected from accidental injury.

The mobilization of the lowest sigmoid is readily effected by incisions along the broad ligament just under the ovaries and tubes in the female, or at the same situation in the male. These are joined by a transverse incision at the bottom of the Douglas pouch. By identifying and separating the ureters this entire portion of the bowel can be lifted cleanly from the hollow of the sacrum. The superior rectal artery comes readily with the intestine, but the middle sacral, which is usually present, and may be of considerable size, must be caught and tied.

In the removal of malignant growths of the large intestine, it will sometimes be found that a neighboring viscus has become involved and is attached to it. If conditions otherwise are favorable this should not be looked upon as a contra-indication to operation. We have in such cases five times resected portions of the small intestine, on two occasions resecting two entirely independent loops of ileum, and after completing the resection of the small intestine we have removed the diseased colon with the fragments of small intestine attached.

Twice we have removed portions of the stomach which were attached to tumors of the transverse colon, and three times the bladder has been involved, necessitating partial removal of the bladder wall. One of these cases was very interesting because of the now three-year recovery of the patient after the removal of a considerable portion of the bladder wall, which was attached to and involved in a low-lying sigmoid cancer. Quite frequently in the female the ovaries, tubes and uterus become attached to sigmoid growths, and it adds but little to the difficulties and dangers of the operation to remove these attached organs from before backward in one mass with the original disease.

Method of Anastomosis.—In our experience it has made comparatively little difference by what method the anastomosis was accomplished as long as the opening was large enough. Granting that end-to-end intestinal union is ideal, the result of the lateral, or end to side, have been, functionally, just as satisfactory. In union between the large and small intestine we have usually made the lateral operation by suture, leaving as small a pouch as possible beyond the opening—and it seems to be quite immaterial whether it is made isoperistaltic or antiperistaltic—which ever way the intestine will come together without angulation or traction; but in lateral union between two parts of the large intestine the resection should be isoperistaltic and the openings brought close to the stump ends so as not to leave a distal pouch. Ileocolostomy is the safe operation because the contents of the ileum are fluid as compared with the solid or semi-solid character of the matter in the colon.

In end-to-end resection of the large intestine it is rather necessary for a safe anastomosis that at least one of the fragments should be well surrounded by peritoneum. In the ascending and descending colon and the iliac sigmoid, the inadequacy of the peritoneal covering may result in fistula formation, a condition which is most troublesome to heal.

For this reason in like cases resection of the sigmoid has a much higher mortality than resection of the cæcum.

The lateral operation gives very satisfactory results in such cases. If there is marked obstruction and distention, the three-stage operation of Mickulicz and Paul has much to commend it. At the first operation the tumor, with the mesentery and glands well detached, is drawn out of the wound and the proximal and distal loops united by sutures. The part to be excised is then, if possible, drawn through a separate incision in the abdominal wall of just sufficient size to carry it easily and hold it in good position. The peritoneum is united by a few interrupted sutures to the two limbs of the intestine on the inner aspect. If the symptoms of obstruction are severe, a small incision is made in the exposed mass proximal to the obstruction, and a rubber tube is introduced through which the intestinal contents are carried into a receptacle. The tumor with the attached intestine is cut away on the third to fifth day and a heavy clamp applied to the spur on the twelfth to sixteenth day; this bites its way through about six days later.

Of late, we are doing the three-stage operation less frequently, as it does not permit of such extensive and careful dissection as is necessary for the removal of the lymph channels, and the patient is subjected not only to a tiresome convalescence and unpleasant external fecal discharge for a number of days, but a secondary operation may become necessary for complete cure on account of fecal fistula.

In all resections we now use the two-row suture method with holding-clamps, and I would say again that the importance of the method of anastomosis, whether end-to-end, side-to-side or end-to-side, has been exaggerated. The more nearly the intestine approaches the normal the better the prospects of end-to-end anastomosis, but with a distended intestine from obstruction, the less the mesenteric attachment is handled the better, and the lateral method is safe and satisfactory. On several occasions I have had an opportunity to see the result of lateral anastomosis after one year or more, and only a small elbow, at most, marked the site of the union.

In making resections one is not always satisfied with the appearance of the bowel union, and fears leakage. We have in several instances fastened the anastomosed part to the peritoneum just underneath the incision, carrying down to it strips of rubber tissue so that if leakage occurred it could readily make its way to the surface, or the entire anastomosis can be suspended on a roll of rubber tissue in such manner that in a few hours it will become protected by adhesions to the peritoneum at the site of the abdominal wound. Gauze should not be used for this purpose as it becomes entangled in the plastic lymph and is quite often followed by fistula.

There is a group of low-lying sigmoid tumors which are exceedingly difficult to get at and where a combined abdominal and perineal operation becomes necessary. As a rule, the whole of the rectum must be removed and the sigmoid attached to the anal muscles, although occasionally the cut end can be united directly to the rectal stump by the method of Tuttle, Maunsel or Weir. After direct union between the sigmoid and rectum we have passed a three-fourth inch rubber tube with an oblique end and lateral eye from the anus upward into the sigmoid several inches above the union and fastened it by a suture to the anal margin. This tube is left from four to ten days to carry gas and fæces by the suture line. In two cases of this type we closed the end of the rectum completely, leaving it as a pouch, and made a permanent left inguinal colostomy.

The abdominoperineal operation for low-lying sigmoid growths has been unusually fatal in fleshy males. On two occasions, in males weighing 200 pounds or more, we have removed the tumor by the posterior route, by an incision which passed from the anus upward along the left side of the sacrum, excising the coccyx. The anus was closed with sutures and the rectum dissected out of its muscular bed. The peritoneum was opened in front and the entire rectum with the fat and glands lifted from the seminal vesicles, prostate and bladder. By lateral incisions the peritoneum was separated and the rectum, tumor and necessary sigmoid amputated, the proximal end of the sigmoid carried down to and sutured into the muscles below. We have followed the recommendation of Peck and left the distal end of the sigmoid closely sutured for four to seven days following operation. In this way we have obtained complete primary union and had a fair muscular control in four weeks.

One would suppose that complete obstruction of the intestinal stump for several days would lead to great distress if not to more serious effect upon the patient, but if the bowel is allowed to become quiet for twenty-four hours before operation, and if during the time of complete obstruction the patient is kept on albumin water, strained soups, etc., the majority will go three or four days, or more, without much trouble. This effect can be continued for a day or two longer if the gas pressure becomes great, by putting a small cannula with a rubber tube attached into the projecting sigmoid stump, to carry off the gas.

In several low-lying carcinomas in the female, where the patient was very much reduced from bleeding and sepsis, we have done the Quenu-Tuttle perineal resection of the entire rectum and lower sigmoid with satisfaction.

I am quite well aware that the posterior and perineal routes are not to be recommended for sigmoid tumors, but in the obese and the very anæmic, operations of this type are well borne, and have, in our hands, been followed by complete recovery.

Any one trying it for the first time in these cases will be surprised at the ease and safety with which the rectum, sigmoid, and tumor can be removed, together with the fat and glands, to a point as high as the promontory of the sacrum.

III.—ONE HUNDRED CONSECUTIVE RESECTIONS OF THE LARGE INTESTINE IN THE ADULT.

In the 100 resections there were 12 deaths, a mortality of 12 per cent. Most of the deaths were due to sepsis and exhaustion, and they illustrate the baneful influence of obstruction which was present in nearly all of the fatal cases. This brings up the question as to whether preliminary colostomy or enterostomy is generally advisable as a preparatory measure in severe obstruction.

When it is possible, we prefer to resect at the primary operation, contenting ourselves with emptying the proximal side of the intestine of its contents. But if the intestinal wall is thickened and soggy, threatening the security of the suture line, a preliminary colostomy is advantageous. The opening is not, as a rule, closed at the time of resection, but is allowed to remain open as a safety-valve and closed later if necessary.

Of the 100 resections 61 were for malignant disease with 8 deaths, and 39 for benign conditions with four deaths. Surgically speaking, it is wise to consider malignant disease of the colon in three anatomical groups.

GROUP I. *Cancer.—The Cæcum and Ascending Colon* was removed for cancer 24 times with 3 deaths. Twenty-three were carcinoma with 2 deaths, and 1 sarcoma with no operative mortality.

GROUP II.—*The Transverse Colon,* including the hepatic and splenic flexure, was removed for carcinomatous neoplasm 7 times with 1 death.

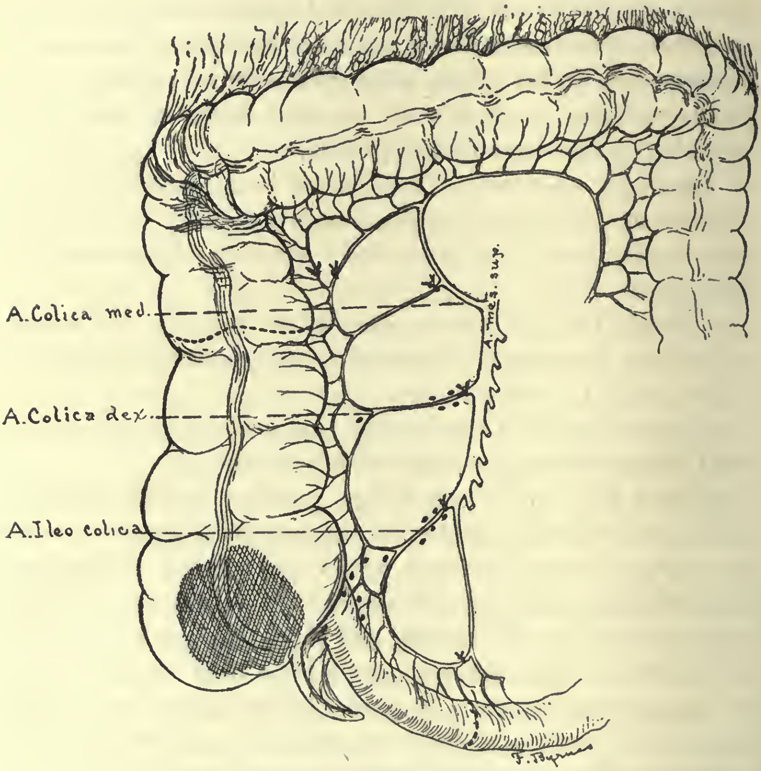
GROUP III.—*The Descending Colon and Sigmoid* was excised for carcinoma 30 times with 4 deaths.

GROUP I. *The Cæcum* (Figs. 3 and 4).—The ascending colon is classed with the cæcum because many cancers involve the margin of the ileocæcal orifice and extend upward into the ascending colon and downward into the cæcum, therefore possibly involving the ileocolic and right colic group of glands.

The first step in the resection of the head of the colon is to liberate the cæcum and ascending colon by an incision through the outer peritoneal attachment, and with a piece of gauze the intestine with the tumor and fat is wiped cleanly to the muscles as far as the superior mesenteric origin of the ileocolic and right colic vessels, which are tied at once, enabling a sure dissection of the mesenteric glands and fat.

The greater ease and safety with which union between the small and large intestine can be secured as contrasted with resection in continuity of the colon, is of great technical advantage. This is equally true of resection of the hepatic flexure. Looked at from a purely technical standpoint, a carcinoma existing at any point between the ileocæcal orifice and the juncture of the right with the middle two-thirds of the transverse colon can be most safely treated by complete resection of all the large bowel up to that point, and this also most effectually removes the lymphatics.

FIG. 3.



Carcinoma of cæcum. Dotted lines show lines of resection.

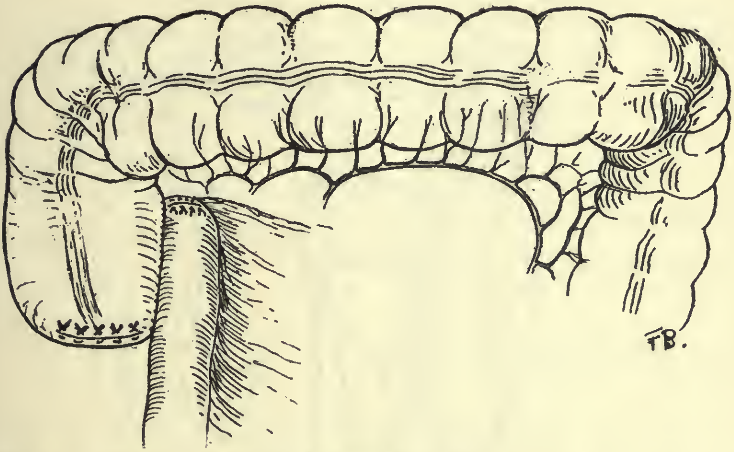
In carcinoma of the cæcum it is necessary to remove the ileocæcal group of glands with the ileocæcal mesentery, and, therefore, not less than the terminal 6 inches of the ileum must be excised. The ascending colon should also be excised in order to secure the right colic vessels and tributary glands.

The type of disease was usually found to be *adenocarcinoma* and the ileocolic glands were nearly always affected.

In some specimens the disease appeared to have had its origin in the appendix. However, the appendix was so thoroughly involved as to make it impossible to arrive at any accurate conclusion on that point.

In the past three years we have operated upon and recognized microscopically six cases of primary appendiceal carcinoma, one-fifth of one per cent. of the total operations for appendicitis in that time. As pointed out by Harte, cancer of the appendix is usually of small size, not larger than a pecan nut. It is seen most frequently in the second and third decades as contrasted with adenocarcinoma of the cæcum, which is most frequent in the fourth and fifth decades of life. Primary carcinoma of the appendix is of the spheroidal or basal-cell type. It seldom involves the lymph nodes, although LeConte reports one such case. In two of our cases the microscopic resemblance to endothelioma was striking. While in our cases of primary carcinoma of the appendix the cæcum was usually partially resected, they are not included in the statistics as the continuity of the intestinal canal was not affected by the operation.

FIG. 4.

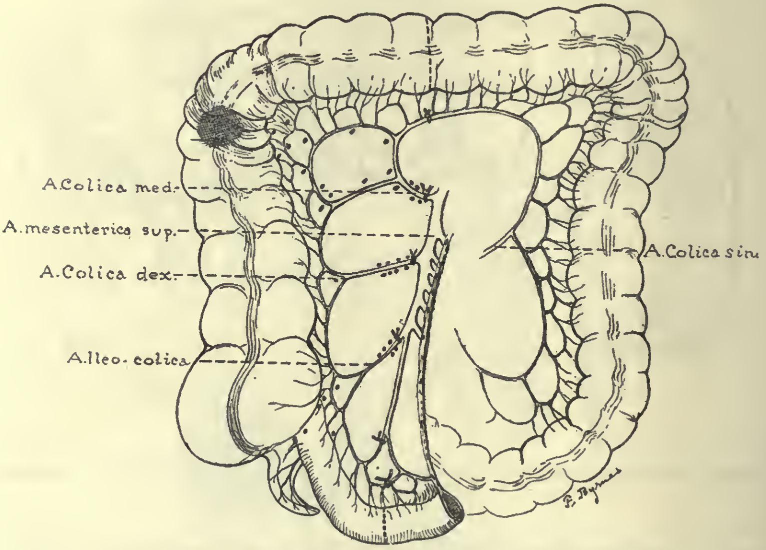


Lateral anastomosis following excision of cæcum and ascending colon, between lower ileum and hepatic flexure.

GROUP II. *Cancer of the Transverse Colon and Flexures* (Figs. 5 and 6).—In this group there were 7 cases with 1 death. The percentage of inoperable carcinomas of the transverse colon in which no operation could be done was higher than in any other group, as there appeared to be relatively early involvement of the lymph nodes about the head of the pancreas.

In resections involving the middle of the transverse colon, the middle colic artery should be ligated early and the separation of the glands started with that vessel. This will at once show the extent of the devitalized colon which must be removed.

FIG. 5.

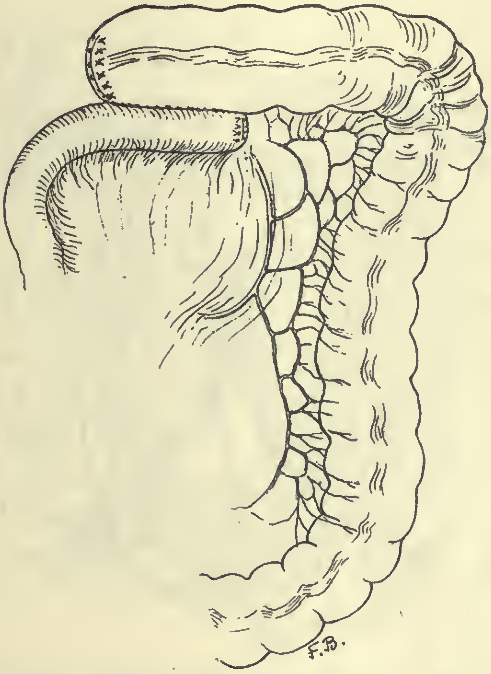


Cancer of hepatic flexure. Dotted lines show proposed resection.

Involvement of the splenic flexure is prone to early and extensive adhesions, and local extension along these pathways of the carcinomatous process is a more frequent bar to resection than lymph metastasis. If the costocolic ligament and the outer peritoneal attachments are divided as the first step of the operation, the splenic flexure is liberated, and with the glands and fat can be drawn well out of the abdomen, and early ligation of the right and left colics at proper points facilitates further manipulations.

Group III. *Cancer of the Descending Colon and Sigmoid* (Figs. 7 and 8).—In this group there were 30 cases with 4 deaths. The steps of operation are similar to those of the cæcum and ascending colon. Liberation by division of the outer peritoneal folds, and early ligation of the blood vessels at their origin, enables easy removal of the glands and fat so that resection can be completed outside of the abdominal cavity. Ideal resections with complete removal of the lymphatic tributaries may necessitate ligation of the inferior mesenteric vessel on account of the importance of securing that gland, which, according to Moynihan, almost

Fig. 6.

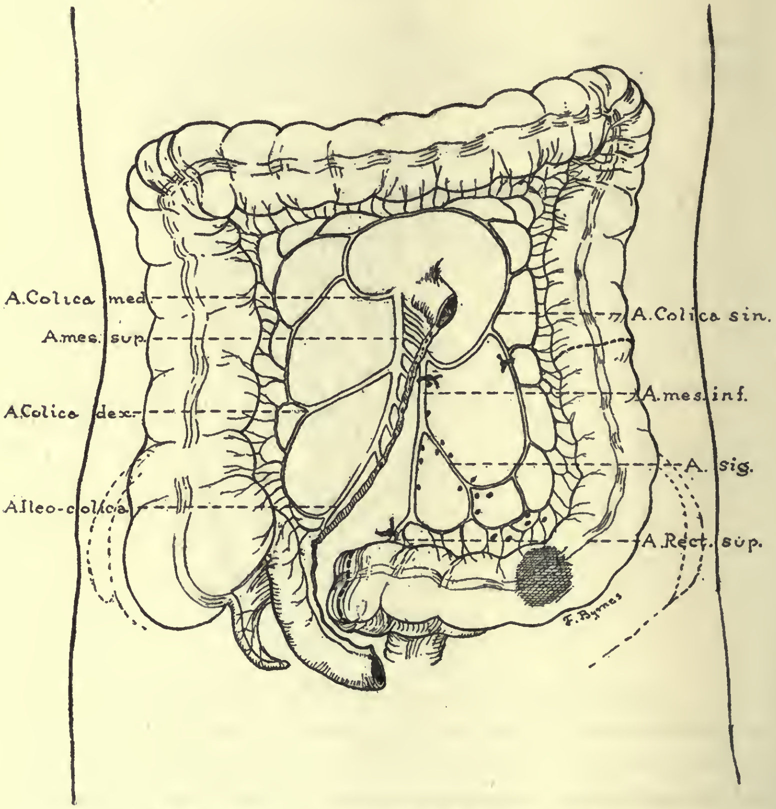


Lateral anastomosis following resection of hepatic flexure between lower ileum and transverse colon.

invariably lies at its origin. Wide removal of the peritoneum and surrounding fat is as necessary as the removal of the glands.

Resections for Benign Disease of the Large Intestine.—Of the 39 resections for benign conditions, 2 involved the entire colon; both recovered. Twenty-four involved the cæcum and ascending colon with 1 death. Two of the transverse colon with 1 death, and 11 of the sigmoid with 2 deaths.

FIG. 7.



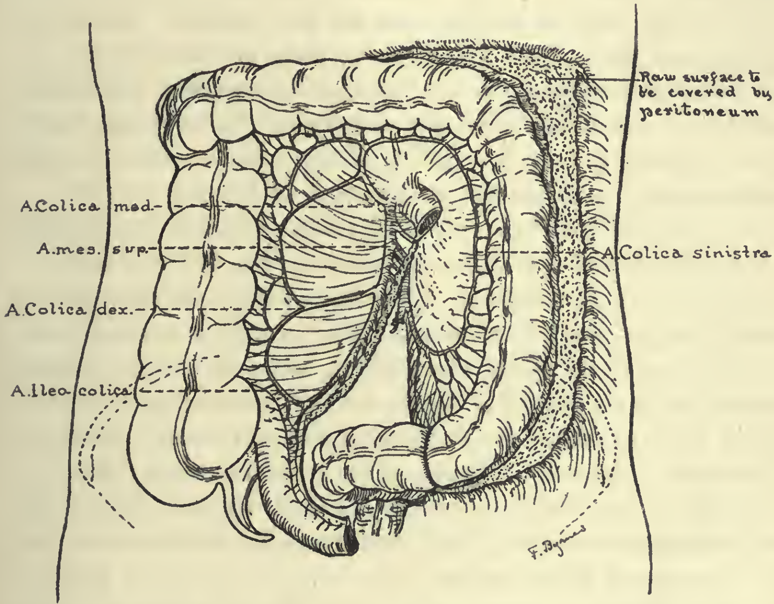
Cancer of sigmoid. Dotted lines show proposed resection.

GROUP I. *Two Colectomies for Chronic Ulcerative Colitis.*—Nearly all the colon was removed; both made a good recovery.

GROUP II. *Cæcum and Ascending Colon.*—There were 24 resections of the cæcum and ascending colon with 1 death.

(*a*) *Inflammatory Disease,* 11 with 1 death.—This group is made up of an assortment of inflammatory conditions in which the continuity of the bowel had been destroyed by infection or its results, such as, sloughing causing large fecal anus at the ileocæcal juncture, impossible of closure by plastic operation.

FIG. 8.



End-to-end anastomosis following resection of sigmoid. Note mobilization of splenic flexure and descending colon.

Three of the latter resections required simultaneous resection of the sigmoid because of previous attempts, not in our clinic, at closing the fecal anus by anastomosing the cæcum to the sigmoid. Attempts to cure fecal fistula by performing lateral anastomosis with the view that short circuiting would permit the fistula to heal is usually a mistake. If there is no obstruction, the vermicular action of the intestine constantly tends to carry the ingesta past the artificial opening along the normal lines of the bowel, and not only is the patient not cured of the disease but a serious complication is added when later it becomes necessary to operate for a definite cure of the lesion. It is a simple matter to circumscribe a fecal fistula by an incision down to the peritoneum at some point outside of the intestinal adhesions and introduce the finger as a guide. The less firm adhesions are swept loose and the circumscribing incision deepened through into the peritoneal cavity. The intestinal loop containing the fistula can be drawn out upon the surface of the abdomen, surrounded with gauze and the fistula closed in the long axis of the intestine by two rows of sutures, the outer row preferably of interrupted linen or silk.

(*b*) *Intussusception.*—A benign fibromyoma of considerable size growing from the vicinity of the ileocæcal valves and projecting into the lumen of the cæcum, causing intussusception, was subjected to resection with cure.

(*c*) *Localized Tuberculosis.*—Twelve cases with no deaths. Tuberculosis of the ileocæcal coil occurs in two forms—ulcerous and hypertrophic. Only one of the ulcerous type was subjected to excision, although a few patients were seen who, when they came under observation, were in a poor general condition with extensive fistulous tracts associated with multiple tuberculosis in the small intestine, and usually with pulmonary involvement. Eleven of the resections were for hypertrophic tuberculosis with well marked tumor, and in the majority it was difficult to differentiate them from carcinoma at the time of the operation.

In addition to these 12 cases in which resection for tuberculosis was performed there were a number in which the local condition was looked upon as being inoperable and some form of exclusion operation was made as a palliation for obstruction. This was particularly true in our early experience before we became aware of the extent to which these operations could be carried, also because we looked upon irremovable lymphatic glands to be a contra-indication to resection. In several instances we have removed hypertrophic tuberculosis of the cæcum with the ileocolic glands, and have left huge tuberculous glands extending up along the aorta as high as the diaphragm, their size varying from that of a walnut to an egg, with complete and permanent cure of the patient. Shutting off the supply of infection evidently enabled nature to overcome the poison which had already been absorbed into the glandular system. In several of the specimens the bovine type only of tubercle bacilli were found to be present.

In 54 cases, 1 per cent. of the total number of appendectomies, the appendix was the seat of tuberculosis. The cæcum was nearly always involved at the base and extensively removed. These cases are not included in the statistics because the continuity of the bowel was not interfered with in the operation. Many were apparently the original focus of an extensive tuberculous peritonitis and the operation was undertaken for this symptomatic condition.

GROUP II. *Resection of the Transverse Colon.*—The transverse colon was resected twice for benign disease, once for diverticulitis and once for fibrolipoma, with 1 death.

GROUP III. *Sigmoid.*—The sigmoid was resected 11 times with 2 deaths. (*a*) In one case of Hirschsprung's disease, or giant colon, the sigmoid with the ascending and transverse colon was excised with cure. (*b*) Fibrolipoma, 1 resection with recovery. (*c*) Two for tuberculosis, 1 of the ulcerous type and 1 of the hypertrophic variety; both recovered. (*d*) Five were for diverticulitis with two deaths. This last-named condition is very curious and is due to pouching of the mucous membrane through small defects in the muscular coat of the colon in which fecal concretions form and result in acute or chronic inflammation. A well defined tumor is usually to be felt which is tender during the acute stage and accompanied by mild general symptoms of infection. These tumors have often been diagnosed as carcinoma, and in three out of five resections for this condition in the colon the diagnosis was only cleared up with the microscope. For a full report of five of these cases see article by Mayo, Wilson and Griffin, in *Surgery, Gynecology and Obstetrics,* July, 1907.

The sigmoid was resected for inflammatory pelvic disease two times with recovery.

In the group of resections we have not included a considerable number in which the sigmoid was more or less involved or injured in the course of operation for diseases of the pelvic organs, as the consideration of these should be undertaken in connection with the diseased processes of which they were the accidental rather than a primary part.

I am indebted to Dr. M. S. Henderson for compiling the following table of statistics from the records at St. Mary's Hospital, and also for the correspondence involved in ascertaining the present condition of the patients.

ONE HUNDRED CONSECUTIVE RESECTIONS OF THE LARGE INTESTINE IN THE ADULT. OPERATIONS PERFORMED AT ST. MARY'S HOSPITAL, ROCHESTER, MINNESOTA, BETWEEN FEBRUARY, 1898 AND FEBRUARY, 1909.

Of the 100 resections 61 were for malignant disease with 8 deaths (13 per cent.).

CANCER OF THE CÆCUM AND ASCENDING COLON.

Number of cases	24
Male	17
Female	7
Age of oldest	72
Age of youngest	31
Average age	48
Patients of ages between 30 and 40 years	7
Patients of ages between 40 and 50 years	11
Patients of ages between 50 and 60 years	2
Patients of ages between 60 and 70 years	3
Patients of ages between 70 and 80 years	1
Average duration of symptoms 13 months.	
Operative mortality (12.5 per cent.)	3
Patients dying within 1 year after operation	1
Patients dying between 1 and 2 years after operation	3
Patients alive less than 1 year after operation	2
Patients alive 1 to 2 years after operation	2
Patients alive 2 to 3 years after operation	3
Patients alive 3 to 4 years after operation	2
Patients alive 4 to 5 years after operation	1
Patients alive 5 to 6 years after operation	1
Patients alive 6 to 7 years after operation	1
Patients alive 7 to 8 years after operation	1
Number not located	3
Total	24

Of 11 patients operated upon more than 3 years ago, 10 have been traced. Six, or 60 per cent., are alive and well to date.

CANCER OF THE TRANSVERSE COLON INCLUDING THE HEPATIC AND SPLENIC FLEXURES.

Number of cases	7
Male	2
Female	5
Age of oldest	66
Age of youngest	35
Average age	52
Patients of ages between 30 and 40 years	1
Patients of ages between 40 and 50 years	2
Patients of ages between 50 and 60 years	2
Patients of ages between 60 and 70 years	2
Average duration of symptoms 16 months.	
Operative mortality (14 per cent.)	1
Patients dying 1½ years after operation	1
Patients dying 2 years after operation	1
Patients alive and well 1 year after operation	2
Patients alive and well 3 years after operation	1
Number not located	1
Total	7

CANCER OF THE SIGMOID.

Number of cases	30
Male	21
Female	9
Age of the oldest	71
Age of the youngest	31
Average age	52
Patients of ages between 30 and 40 years	5
Patients of ages between 40 and 50 years	7
Patients of ages between 50 and 60 years	8
Patients of ages between 60 and 70 years	8
Patients of ages between 70 and 80 years	2
Average duration of symptoms 2 years.	
Operative mortality (13 per cent.)	4
Patients dying 1 year or less after operation	3
Patients dying 1 to 2 years after operation	5
Patients dying 2 to 3 years after operation	1
Patients alive and well 1 year after operation	7
Patients alive and well 1 to 2 years after operation	5
Patients alive and well 2 to 3 years after operation	2
Patients alive and well 3 to 4 years after operation	3
Total	30

Out of 6 cases operated upon more than 3 years ago, 3, or 50 per cent., are alive and well.

RESECTIONS FOR BENIGN DISEASES OF THE LARGE INTESTINE.

Number of cases	(4 deaths—10 per cent.)	39
Colectomy for ulcerative colitis (nearly all of the colon removed)		2
Cæcum and ascending colon		24
Localized tuberculosis		12
Inflammatory disease		11
Intussusception		1
Transverse colon, including hepatic and splenic flexures		2
Diverticulitis		1
Fibrolipoma	(1 death)	1
Descending colon and sigmoid		11
Tuberculosis		2
Diverticulitis	(2 deaths)	5
Fibrolipoma		1
Hirschsprung's disease		1
Inflammatory disease		2
Total		39

DISTORTION OF THE MESENTERY AND ITS RELATION TO INTESTINAL OBSTRUCTION.*

BY JOSEPH D. BRYANT, M.D.,
OF NEW YORK,
Surgeon to Bellevue and St. Vincent's Hospitals.

FOR the purposes of this occasion, Distortion of the Mesentery is considered to mean the twisting or otherwise forcing out of shape of the mesentery by disease process, and thereby so disarranging its normal relation with the attached intestine as to change the orderly course of the latter with reference to it. Torsion of the mesentery, as commonly expressed, is not included in this title. It seems not at all unreasonable to conceive that the forcing out of shape in this manner of the mesenteric curtain, to the lower border of which the intestine is attached, would change the normal relations existing between them to a sufficient degree as to modify correspondingly the functions of the included intestine.

The stimulus prompting the conception of the title and promoting the birth of this paper, had its origin in the strikingly interesting, and, to me, instructive features incident to a case recently coming under my notice from lay sources, which was characterized by long-standing and progressively increasing symptoms indicative of intestinal obstruction. The nature of the obstructing cause was at first problematical, being regarded as functional; then, as functional with organic complications, the latter of which finally dominated the varying picture of distress so long as the patient remained under observation. It, therefore, naturally follows that the syndrome of this case is divided into two parts, viz.: the early or the recounted part, and the later or the observed part, at least, so far as the writer is concerned. And, in expressing the indications of disorder in this instance, especially those manifestations will be told which are regarded as not being inconsistent with a belief in the peculiar nature of the obstruction, and its probable location. A plan like this necessarily eliminates, except for comparison, many of the multitude of common symptoms of intestinal obstruction, and correspondingly abbreviates and emphasizes the text and the facts that are regarded as being expressly related to the problem.

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* Read by title before the American Surgical Association, June 3, 1909.

It appeared, in this instance, according to the recounted symptoms, that, at longer or shorter intervals of time for several years, there had occurred brief attacks of intestinal colic usually accompanied with nausea and vomiting, as the distinguishing traits. The frequency and severity of the attacks, though differing in degree from time to time, gradually increased in these respects, until the uncertainty of the time of their coming and going, and of their severity, obviously founded a most unhappy and insecure state of affairs. Usually, in these instances, however, a mild anodyne, supplemented with a gentle cathartic, afforded prompt relief—a relief commonly marked by copious evacuations of semi-solid material, sometimes with distinctive features of indigestion, but with no evidence of obstruction. Afterward, however, a decided change occurred in this, the negative feature of the case. For, in an attack apparently induced, as often before, by indiscretion in diet, it is recounted that there developed after twenty-four hours, genuine symptoms of intestinal obstruction, which refused obedience for forty-eight hours longer to the usual remedial means employed in these instances. Soon after, however, a copious bowel evacuation succeeded an escape of offensive flatus, the apparent sequel of a deferred, hopefully employed, high enema. Complete comfort followed at once. But, singularly enough, within an hour after the stool, nausea ensued which was promptly and finally relieved by abundant vomit having a distinct fecal odor. Also, it is told that during the height of this attack, the turpentine and the asafœtida separately employed in the high enemata for the purpose of fecal dislodgement were tasted by the patient soon after their introduction. A fact which happened thereafter, it is said, on two occasions with the use of asafœtida with a similar intention. After the prompt subsidence of this attack, I was told that comparative quiet reigned in the abdominal affairs of the patient for nearly eighteen months. Before, during, and subsequent, to this attack, nothing of diagnostic significance related to the affliction, could be ascertained by physical examination so long as the patient came under our notice. Later, the painful digestive attacks increased in frequency, happening once in four or five weeks, in fact, were not infrequently prompt complications of slight constipation and of errors in diet. And, too, before final relief from an attack came in sight, fecal vomit in varying amounts was in evidence—at least, once in three or four months. And, at one time, the attacks bid fair to wear the patient out through the torment of spirit and physique, which they imposed at uncertain intervals.

The pain was rarely severe, it being often readily controlled by a small amount (⅛ or $^1/_{10}$ grain and less) of morphia, given hypodermically once in six or eight hours. The pain was located primarily, and throughout the attack, in the navel region. It sometimes came suddenly without premonition; again with a sense of indefinite gastric or abdominal distress; and often in a gradual manner, with or without important manifestations. Some general tenderness of the abdomen was present, especially if the attack was severe, but no circumscribed points of tenderness could be determined in slight or severe attacks until late in the history of the case, when, after severe attacks, varying and vague points of tenderness were noted only in the navel region. The region of the appendix and of the gall-bladder, however, was free from all uncomfortable manifestations. Local or general tension of the abdominal muscles was never observed. Tympany was absent during slight attacks, and was not pronounced during the severe. The pulse exhibited but little change from normal, except during the later part of my observation, when it, very naturally, was accelerated by pain and fever. The temperature (rectal) rarely reached 100 F. until during the later attacks, when it would go up a degree or two, and even higher, and then suddenly fall a degree or more in a few hours (6 or 8) before the symptoms of obstruction were relieved, usually by copious alvine dejections. So constant was this phenomenon in these later attacks as to become of special significance as indicating approaching relief. During the last two attacks known to me, the remission was quickly followed by abdominal pain, and return of temperature which, soon after, resumed the usual low figure of the preceding attacks. It would seem as if in these special instances, brief arrest of recovery had happened, resulting, perhaps, in slight re-obstruction and consequent increased degree of infection. Especially so, since their temperature of 103 F. and 104

F. for a short time, would then suddenly fall to nearly normal, attended with perspiration. Nausea was common with the onset of the pain, and often vomiting, the vomit being composed usually of the contents of the stomach, followed by bile. In several instances, however, the vomit became fecal, sometimes very promptly and unexpectedly, and once, primarily, then again, later in the course of the attacks. In one instance, free fecal vomiting, and a simultaneous large stool terminated at once a seventy-hour period of apparent obstruction. In this instance, the physical characteristics of the two discharges, oral and anal, were similar in color, odor, and consistency. The color was brown, the odor fecal, and the consistency semifluid. A chemical examination of these discharges disclosed the presence of indol and skatol in each, and with but little more of these agents in the stool than in the vomit,—a difference which, at the time, might well have prompted the thought that the intestinal obstruction, in this instance, divided somewhat equally the field of abnormal development of these substances. For, were the obstruction located at the proximal side of the region of development, one would not expect the presence of either substance in the vomit.

In the majority of attacks, the symptoms of intestinal obstruction yielded quite promptly to high enemata and colonic irrigation. At times, however, these agents produced no apparent effect, even on repeated employment. It sometimes would seem as if the obstruction—at uncertain periods (30 to 75 hours after attack)—would yield more to intestinal effort than to human contributing influences. That is to say, the morbid physiology of the intestine itself apparently was more potent for relief on these occasions than were the special efforts of those in charge of the case. In one instance, however, when other measures afforded no relief, two quarts of warm sweet oil, slowly introduced as high as possible into the bowel, were, in the course of an hour, followed by copious discharges of soft fecal content, succeeded by prompt relief lasting for a brief period. A curious sequel to this experience was the frequent passage in the stools for about twenty-four hours, of varying small amounts of sweet oil. It appeared as if the oil had been sequestered in the bowel, so as to be returned in divided portions from time to time, as the actions of the bowel would require. Also a manifestation which pointed to the presence of isolated collections of fecal matter in the small intestine, happened in two instances later in the history of the case in the following way: The administration of a saline cathartic was followed promptly only by brown watery evacuations strongly impregnated with indol and skatol. This result would not be expected in the instance of an empty colon already rinsed well by saline catharsis and irrigation. In these instances, however, a liberal dose of castor oil was promptly followed by a large soft fecal evacuation. It therefore appeared as if the fluid dejections had passed across or through disseminated accumulated fæces in the small intestine, thus staining and impregnating them with indol and skatol. For, had the amount of fecal gathering disclosed by the cathartic been circumscribed in the small intestine, there is no doubt that tumor would have been present on manipulation, hence the belief in circumscribed dissemination. In the second instance, after ingestion of milk the rapid appearance per anum of milk-colored discharges followed by an abundant fecal movement from castor oil, suggested the presence of fecal accumulation in the small intestine, especially when the colonic irrigating fluids, just before employed, had been returned uncolored. Again on frequent occasions, test doses of two grains of bismuth by mouth, in the instance of fluid diarrhœa, promptly discolored the anal discharges, thus clearly demonstrating the fact of incomplete obstruction and the absence of a special diarrhœa of irritation from below. And, too, following this, the normal fecal discharges returned without the help of remedial agents, suggesting the further idea that but little, indeed, of the fluid discharge could have come from a local intestinal irritation caused by a fecal accumulation.

It is but fair to say at this time that careful observation and study of the phenomena noted in this case, convinced the writer that, for some reason, an S trap-like arrangement in the course of the small intestine was present, and likely, too, in plural number, at the lower curves of which passing fecal matters accumulated sufficiently on different occasions to cause more or less, and sometimes complete obstruction, often accelerated by indigestible matters of sufficient amount or suitable size, to completely and suddenly occlude the remaining part of the lumen. More often, however, it was believed that the pockets were emptied by local intestinal muscular contraction with more or less pain attendant thereon, and, at other times, wholly, or in part by the aid of cathartics, more especially castor oil. As already intimated, it was believed that at times an incomplete occlusion was present, leaving only sufficient space to permit of the passage of saline evacuations over the fecal accumulations in the dependent parts of the receptive loops of the deformed intestine, thus tincturing the passing fluid with indol and skatol. The prompt passage, at times, of undigested milk and of bismuth-stained fluids for test purposes also served to substantiate the belief in incomplete obstruction. And, too, on careful thought no other form of intestinal obstruction appeared so well to meet the syndrome of this case. It was not improbable that this obstruction was located in the ileum not far from the cæcum, and also that the ileocæcal valve at times was pervious to fluids from below, and that active reverse peristalsis was a prominent feature.

It should not be amiss now to further interpret, so far as practicable, the other various phenomena which pointed toward and added interest to the pathologic picture just sketched.

The tasting on different occasions of the turpentine and asafœtida employed in high enemata for the purpose of overcoming intestinal obstruction, suggests at once that the obstruction could have not been complete, though so regarded at the time. Also, that reverse peristalsis had been rapid and pronounced at the time, as taste of the drugs happened during the brief retention of the enema. And, besides, for some reason, the ileocæcal valve was not on guard in a manner commonly supposed to characterize its office. In this connection, however, it is proper to say that intestinal peristalsis is not as simple a mechanism as is commonly supposed, and that antiperistalsis especially is a phenomenon the intricate nature of which is, as yet, not entirely settled.

Practically, however, antiperistalsis is reported as having carried nourishing and medicated agents from the rectum to the mouth in a brief time in many instances. The writer in 1892, in a hysterical patient, observed the vomiting from a test glycerine and methyline violet enema twenty seconds after its introduction into the bowel. A suspected communication in this case between the colon and the stomach was disproved by explorative examination. About the same time, the attachment of the divided ileum to the sigmoid flexure was practiced by the writer in order to short-circuit the intestinal contents in the instance of an obstinate fecal fistula of the transverse colon. But, only a change in the consistency of the fecal discharge was observed, as the soft discharges of the ileum were carried up the descending colon by retrograde peristalsis, and escaped as before from the cutaneous opening of the fistula. Also, as a matter of established fact, and apparently shown by this case, a continuous peristalsis going rapidly from the rectum to the stomach, and, another kind arising at an irritated part of the intestine, and going from it in opposite directions may take place.

That the inhibitory influence of the ileocæcal valve on peristaltic intercourse of the large and small intestines cannot be regarded as definite, is evidenced by the report that in 60 per cent. of subjects (Debierre) the valve is found to be permeable from below.

It seems permissible now, to point again and more fully to symptomatic features of the case which had been regarded as being of special significance in connection with the peculiar form of obstruction to which they had been assigned. Among them may be classed the nearly equal amounts of skatol and indol contained in the fecal matters simultaneously discharged from the mouth and anus. Of course, I was aware of the flood of fallacies that beset this proposition, but, it came to my mind and was not dismissed. The normal habitat of these diagnostic products of fecal substance is peculiar to the cæcum and the first part of the colon. And, in this instance, it appears that the ileocæcal valve was pervious from the colonic side. Therefore, at first sight, it could be easily said that primarily both oral and anal dejections were largely the product of cæcal and colonic activities, whose respective exits were made possible by the presence of an obliging ileocæcal valve. But, if such had been the case, the amount of skatol and indol in the oral dejection might well have exceeded that of the anal, since, to the contents of the cæcum and nearby colon are these products easily peculiar. But inasmuch as the processes of decomposition breed skatol and indol anywhere in the intestine, in amounts proportionate to the contributing influences, and, as in this instance, the putrefaction changes were general throughout, and, also, that an incomplete hindering obstruction of some sort was lying between the cæcum and the stomach, it was not singular, and one would expect the greater amount of these products to favor the anal exit of the area of their natural production. Also, classed as indicating the possible location and probable mechanism of the obstruction, will be recalled certain facts already stated in the early history of the case viz.: The slow development, too slow, in fact, for the progress of the common kinds of intestinal obstruction. And the associated indications conform therewith. The phenomena recounted regarding the high sweet oil enema; the colonic irrigations; the skatol and indol impregnations; the milk and bismuth exhibitions; the castor oil responses; the forecasting indications of spontaneous relief, etc., etc., appealed to the author with sufficient force to put in mind the theory already expressed, *i.e.,* "an S trap-like arrangement of probably multiple parts in the course of the small intestine." This theory was promulgated before a tangible opportunity was afforded to determine the seat and mechanism of the obstruction by means of material examination. Finally, however, by so doing, it was determined that nothing physically appreciable was at fault with the colon, the cæcum, or the appendix. The first four or five inches of the ileum were normal. The succeeding seven or eight inches and the mesentery connected therewith were abnormal, the latter being distorted by chronic inflammatory process, so as to cause scalloped irregularities of the attached intestine for a corresponding distance. The wall of the intestine at this situation was much hypertrophied, thus giving rise to marked encroachment on the lumen of the gut, which otherwise was enhanced in places by the acute angles of the scallops themselves. The intestine proximate to the obstructed part was moderately dilated and hypertrophied for a considerable distance.

The marked hypertrophy which characterized the disordered part of the intestine is regarded as the natural product of its crippled condition, especially in view of the well-known fact that the interference with the normal flow of a fluid through its natural channel at once provokes functional resentment of a greater or lesser degree on the part of the motor forces interested with the conduct and care of the function. And, also, that the effort required to keep pace with the demands of increasing interference develops the compelling forces correspondingly, as is made manifest by the increasing growth of the responsible parts engaged in the duty of functional activity and preservation. We can quite easily understand how, as in this instance, that near-together consecutively arranged developing interferences (scallops) with intestinal function could, sooner or later, cause slight, temporary, and finally more or less decided obstruction to the flow of the intestinal contents, attended with corresponding increase in dimensions and power of the propelling force, as represented by the muscular development of the part thus directly involved.

It would appear to me that the disclosures of the examination have reasonably established the conjectural diagnosis as related to the location and the mechanism of the obstruction. Also, that the phenomena recounted in connection therewith fit the physical findings amply, certainly much better than they can be adjusted to the mechanism of a different form of intestinal obstruction.

A careful examination of the literature of intestinal obstruction as related to mesenteric distortion (not volvulus) by competent persons, reveals no instance of similar intestinal disfigurement, or of like clinical history. In one instance only it appeared that the pressure of a large tuberculous mesenteric gland on the veins of the mesentery of the ileum had produced œdematous thickening of the walls of the corresponding part of the intestine to a degree causing sufficient closure of the gut, and modification of its functions to produce acute intestinal obstruction, for which resection of the part was made.

What I have offered, on this occasion, is most respectfully submitted, and, for the time being, is all I would care to say regarding a matter which only time and multiplied opportunities can fittingly adjust to the topic of intestinal obstruction.

I. STRANGULATED RETROPERITONEAL HERNIA OF THE INTERSIGMOID FOSSA. II. INTERPARIETAL VENTRAL HERNIA AT McBURNEY'S POINT. III. RESECTION OF FOUR FEET OF INTESTINE FOR INTESTINAL OBSTRUCTION FOLLOWING REDUCTION OF STRANGULATED HERNIA EN MASSE FOUR MONTHS BEFORE.*

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I. STRANGULATED RETROPERITONEAL HERNIA OF THE INTERSIGMOID FOSSA.

INFANT, male, born September 8, 1907, weighed 7½ pounds, apparently in every way normal at birth. The only unusual thing noticed the first 24 hours was the fact that the child cried almost constantly, and occasionally would spit up a little mucus; he had two meconium stools, passed normally. He continued to take sugar water and a mixture of 2:20 milk, without vomiting. The second day he continued to cry nearly but not quite so badly as during the first 24 hours. At the end of the second day, when the mother's milk began to come, he was put to the breast and suckled satisfactorily. There were no satisfactory bowel movements after the meconium stools, though the napkins were stained occasionally with fecal matter. I saw the child 24 hours after birth, also at the end of the first 48 hours, and could detect nothing abnormal in the abdomen. On the evening of the second day, 54 hours from birth, the nurse thought the abdomen was more distended and somewhat harder on the left side and did not think the child was exactly right. The crying continued. The baby nursed well, however, during the night; and, when seen by myself the following day at noon, 72 hours from birth, the nurse stated that the baby seemed very much better; she said it was nursing well and was getting plenty of milk from the mother. I again examined the abdomen. I found no areas of dulness and could not make out any definite enlargement on the left side, which the nurse stated she had noticed the evening before. The movements, however, were not satisfactory.

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* Read before the American Surgical Association, June 4, 1909.

In the evening of the third day, 80 hours from birth, the child developed a temperature of 102° and began to vomit. I was 16 miles away, but advised, over the telephone, passing a rectal tube and irrigating the bowel. The child had had a small dose of castor oil before. The nurse was unable to pass the tube into the rectum. The vomiting ceased and the child took some milk and slept a good deal between 8 and 10 P.M. The vomiting again began at 1 A.M. and during the two hours it required for me to reach the patient, he was seen by Dr. Mackenzie, the local physician, who tried to pass a catheter and wash out the bowel, but was unable to pass the tube more than 2 to 3 inches. On my arrival, at 4.30 AM., I again attempted to pass a catheter, and although I used three or four kinds—soft and hard—I was unable to get up higher than 3½ inches, from the anus. The catheter then seemed to meet with some obstruction beyond which it could not pass; no fluid could be forced beyond the catheter. The napkins were on two occasions at night stained with yellowish fecal matter, but there was no distinct movement. There had been considerable cyanosis at one o'clock, but at 4.30 the color seemed much better and the general condition was improved. Breathing, however, was rapid and heart action weak. The abdomen at the time of Dr. Mackenzie's visit, at 1.30 A.M., had been much distended and was harder on the left side, in which region, he stated, there was certainly a marked dulness. My examination at 4.30 showed the abdomen symmetrically distended, but there was absolutely no change in note on either side.

At 8 o'clock I made another attempt to irrigate the bowel, but failed; the catheter would go no further than on the previous occasion. I consulted with Dr. Chas. G. Kerley over the telephone and he advised again attempting an enema with Epsom salts and ox-gall. This was tried, but very little could be made to enter the bowel. The child gradually failed and died at 11 o'clock, before Dr. Kerley arrived. Although I was certain of an intestinal obstruction, the child was in no condition at any time since the vomiting began, to stand an abdominal operation.

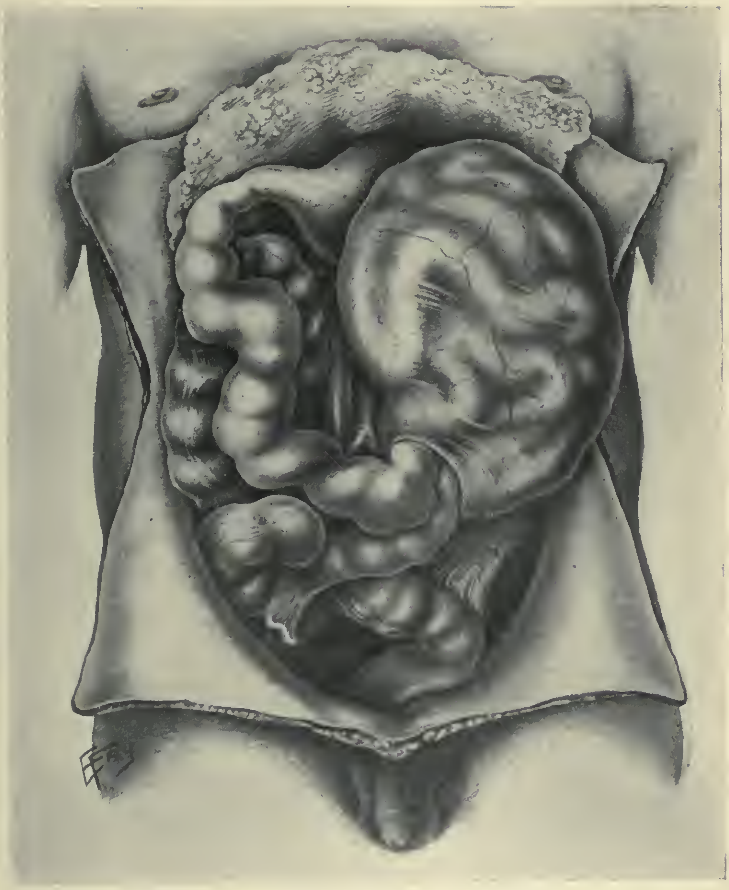
An autopsy was made two hours after death, in the presence of Dr. Mackenzie of Millbrook, New York. On opening the peritoneal cavity, an immense gush of air mixed with an emulsion of fæces poured out, causing the abdominal walls to collapse. Between a pint and a quart of yellowish liquid fæces (there was no pus or anything resembling purulent material present) was found lying in the abdominal cavity. When this was evacuated, I was immediately struck with the absence of the intestine. Careful search revealed only a small loop of small intestine, deeply congested and distended; there was, however, a globular tumor occupying the left side of the abdomen, beginning on a level with the bifurcation of the common iliac artery and extending up nearly to the costal arch. This swelling was smooth, symmetrical, and resilient on pressure. Finally, I discovered at the lower edge of the swelling a semilunar fold of peritoneum, situated a little to the left of the vertebral line and just on a level of the bifurcation of the iliac artery. This semilunar fold formed the neck of the retroperitoneal sac. The aperture was 1¼ inches in diameter, easily admitting the index finger (Fig. 1). The posterior parietal peritoneum had evidently been lifted forward, forming the hernial sac which contained almost the entire small intestine. The sigmoid turned sharply to the right and the whole large intestine was entirely on the right side. The intersigmoid fossa must have been abnormally large, containing some, perhaps nearly all of the small intestine at birth. On the other hand, it is possible that only a portion of the intestine occupied the fossa at birth and that the constant crying during the first two days may have forced more and more of the intestine into the sac until practically the whole small intestine was included and later strangulation occurred.

The opening in the peritoneum in this case corresponds very closely to that of Eve's, although in Eve's case the sac contained only a portion of the ileum, 6 inches in length.

Eve's case was a woman, 63 years of age, and there was present a band of adhesions between ascending colon and sigmoid flexure, which played some part in the etiology.

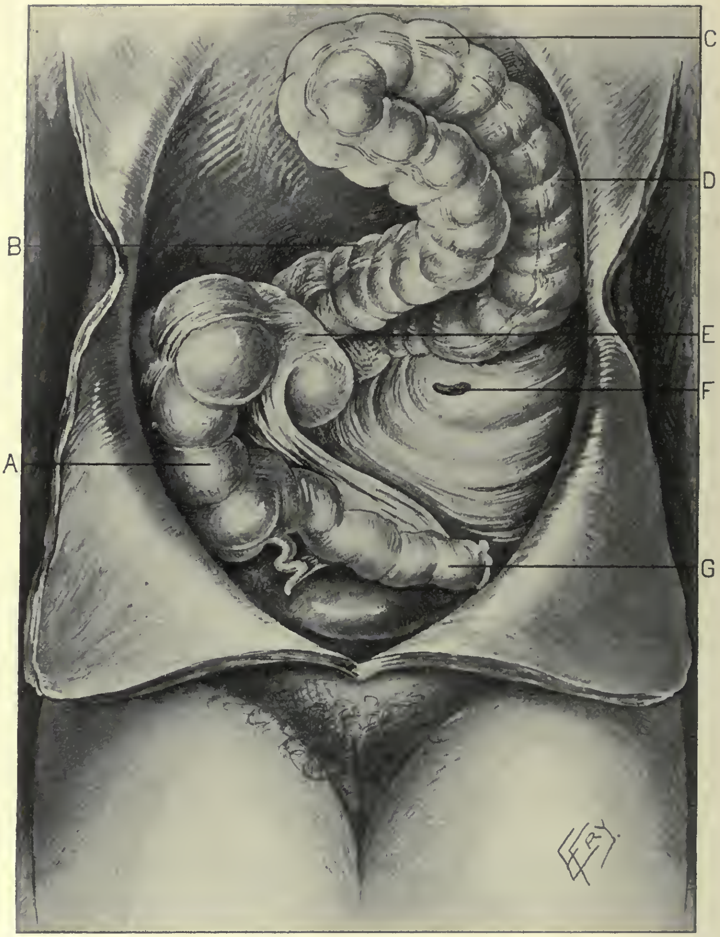
In regard to Eve's case Moynihan states that the most likely explanation is that " there had been originally a common mesentery for the jejunum, ileum, cæcum, and ascending colon. The splenic flexure and the descending colon became

Fig. 1.



Strangulated congenital hernia of the intersigmoid fossa, in child of three days old. (Coley).

Fig. 2.



Eve's Case.—*A*, Cæcum turned forwards; *B*, Ascending colon; *C*, Continuation of colon, bent on itself; *D*, Descending colon; *E*, Band of adhesion; *F*, Fossa intersigmoidea; *G*, End of ileum. (*British Medical Journal*, June 13, 1885).

fixed in the usual manner by the adhesion of the left or posterior layer of the original descending mesocolon to the parietal peritoneum of the posterior abdominal wall. As a result of peritoneal adhesion, most probably pathological, the cæcum and ascending colon had adhered to the descending colon and the sigmoid, and the united gut had been dragged over to the right, laying bare and rendering patent the orifice of the intersigmoid fossa."

In the character and amount of contents my own case corresponds very closely to the case of Treitz, a duodenojejunal or mesocolic hernia. (*La Progrès Médicale,* 1889, tome ii, p. 289.) In Treitz's case the opening of the hernial sac was in the median line a little higher up and the long diameter was perpendicular instead of horizontal. In addition, the transverse and descending colon surrounded the tumor on the upper left and lower side.

My case, as far as I can learn, is the only case of intersigmoid hernia, or for that matter, of retroperitoneal hernia existing at birth. While it is possible that, had the condition been recognized on the first day, an immediate operation might have been successful, still, the difficulties in the way of an early diagnosis in such a young infant must be regarded as very great. In this case there was no localized tumor; the child continued to take food until near the end and vomiting was a very late symptom.

The only three cases of hernia of the intersigmoid fossa that I have been able to find are the cases of Eve, McAdam Eccles, and Lambret. The two former were referred to at length by Moynihan in his well-known work on "Retroperitoneal Hernia." As to Lambret's case, Moynihan stated that he was unable to obtain the journal in which it was reported, namely, *l'Echo Médical du Nord,* 1897, p. 384.

Mr. F. S. Eve regarded his case as the first authentic case of intersigmoid hernia. It was reported in the *British Medical Journal,* June 13, 1885. The specimen has been preserved at St. Bartholomew's Hospital.

This fossa was first described by Hensing and consists of a pouch or depression of the peritoneum forming the left or under layer of the mesosigmoidea, extending to the upper part of the sigmoid flexure.

Eve's patient was a woman aged 63 years; she was admitted to St. Bartholomew's Hospital December 31, 1882. She had always been in good health until December 26, 1882, when at 10 A.M. she was suddenly seized with violent constricting pain around the abdomen in the region of the epigastrium, followed by violent vomiting and the passage of large loose stool. She had had slight attacks similar to this before, which were relieved by purgatives. On December 27 she passed a small movement with little blood and mucus. She continued to vomit all food from the beginning of the attack. The vomitus was at first bilious in character, later became brown, with fecal odor. On December 30, the temperature was subnormal; expression anxious; abdomen was uniformly but not tensely distended; there was incessant retching, but no vomiting. The rectum was free, an enema of warm water returned with some small fecal masses and blood-stained mucus. On January 22, after a consultation, Mr. T. Smith performed the operation for lumbar colotomy. A portion of the intestine was opened and much fecal matter evacuated. The condition gradually grew worse and on the morning of the twenty-fifth she went into collapse and died.

The conditions found in Eve's case are well shown in Fig. 2. The ascending colon took a course obliquely across the abdomen to the left hypochondrium, where it turned sharply to the right and followed the curve of the diaphragm until it reached the middle line; here it became suddenly bent upon itself and returned, above and parallel to its previous course to the lower edge of the spleen; thence it took the normal direction to the sigmoid flexure. Both the ascending and descending portions of the large intestine were closely united and almost surrounded by a single layer of peritoneum. Just above the cæcum, below the level of the hernial opening, there was a band of adhesions 1 inch in breadth and one-half inch in length, binding together the ascending colon and adjacent curve of the sigmoid flexure. Eve believes that this band of adhesions created conditions favorable to a hernia into the intersigmoid fossa.

The fossa itself is not so uncommon. Treves found a perfect fossa in 52 and a funnel-shaped depression in 13, or a total of 65 per cent. of the bodies examined. De Haen ("Ratio Medendi, Paris XI de Ileo Morbo," p. 103) quoted by Moynihan, describes a case of supposed hernia in the intestine through an opening in the mesosigmoidea. This has been referred to by Treitz, but the details are not sufficiently numerous to warrant Moynihan in regarding it as a case of true intersigmoid hernia.

Eve states that it would be useless to form rules for the diagnosis of this form of hernia which the next case would falsify. In both De Haen's and his own case the patient was periodically subject to abdominal pains associated first with constricting sensations and later tympanitis, indicating that the intestine not infrequently had slipped into the opening, but had been released by purgatives or naturally.

In 1895, ten years later, McAdam Eccles (St. Bartholomew's Hospital Reports, vol. xxxi) reports a case of strangulated hernia of a loop of small intestine in the fossa intersigmoidea.

The man, 53 years of age, was admitted to the West London Hospital under the care of Mr. Eccles on August 18, 1895, with well-marked symptoms of intestinal obstruction. He had for many years suffered from double inguinal hernia, both reducible and fairly well controlled by a truss. Four days before admission, while coughing, his left hernia came down and could not be reduced. He was taken to Cottage Hospital, near his residence, in which the surgeon with little delay and some difficulty reduced the hernia by taxis. The vomiting and pain, however, persisted. No fæces or flatus passed the rectum. On the fourth day he was admitted to the West London Hospital in the following condition: Facial expression anxious and typical of acute abdominal disturbance; pulse small and frequent; breathing thoracic; tongue furred; temperature 98.2°, abdomen evenly distended and everywhere resistant; no local swelling or induration could be made out. Under ether a median abdominal incision was made. High up in the iliac fossa in the posterior part of the abdomen was a firm resistant mass into which could be traced the small intestine, one part of which was distended, the other collapsed. Closer examination revealed a tightly constricting edge which afterward proved to be the margin of the aperture of the intersigmoid fossa. The sharp ring was carefully snipped with a pair of scissors and the gut slowly drawn out of its grasp. The loop of small intestine was then liberated. This was intensely congested, and black and gangrenous for a distance of about one-half inch in its middle. The whole loop measured about four inches. The gangrenous piece of bowel with the œdematous portion was excised with a V-shaped piece of mesentery and the ends united by Maunsell's method. The patient died of exhaustion 12 hours later. The record states that the post-mortem examination showed some general peritonitis, most marked in the region of the sigmoid flexure. The suture used in the anastomosis had held well. Nothing further is said about the condition of the intersigmoid fossa as disclosed by the autopsy.

Eccles states that this fossa was distinct in at least half of the subjects examined in the Rooms in 1894-1895, the percentage being 53. This corresponds very closely to the findings of Treves. Eccles states that in the fœtus this fossa is undeveloped. In Eccles' case the tightness of the strangulation was extreme, showing that once a loop of bowel becomes imprisoned, it is very seriously affected in a short time.

A careful reading of the history of Eccles' case must leave some doubt in one's mind whether this condition might not have been one of reduction *en masse* rather than a true hernia of the intersigmoid fossa. The history of a case of strangulated hernia, finally reduced under forcible and prolonged taxis, with a continuation of the symptoms of strangulation is absolutely typical of a case of reduction *en masse*. It does not seem at all probable that the same loop of strangulated bowel that had been reduced from the scrotum, could have been made to enter the intersigmoid fossa after reduction. It seems still more improbable that two loops of intestine could have been simultaneously strangulated, one in the intersigmoid fossa and one in the scrotum; and that when the latter was reduced, the former continued to give the same symptoms. It is reasonable to believe that one condition could have been easily mistaken for the other through the small incision used in the laparotomy, and the actual condition not recognized except by a very thorough autopsy, evidence of which is lacking in Eccles' case. He simply states that post-mortem examination showed some general peritonitis and that the sutures used in the anastomosis held well. There is no further description of the condition present in the fossa itself. (The case has, however, been accepted by Moynihan, the most competent authority.)

The third case of hernia of the intersigmoid fossa, is that of Lambret (*L'Echo Méd. du Nord,* 1897, p. 384). Lambret reports this case as the third known case of hernia of the intersigmoid fossa, stating that the two cases observed up to that time were the case of Jomini and that of Eve. Jomini's case (*Revue Médicale de la Suisse Romande,* 1882) was not accepted as a true case by Moynihan. Lambret describes his case as follows:

Male, aged 63 years, was admitted to the hospital with all the signs of acute intestinal obstruction which had lasted for a period of three days, coming on during an effort at defecation. The patient immediately had very severe pains in the abdomen without any particular localization; vomiting occurred soon afterward and finally became fecal. It ceased the day after his admission to the hospital; there was no passage of either gas or fæces; moderate abdominal obstruction; pulse rapid. Operation was immediately decided upon and it was performed by Folet. A median incision was made from the umbilicus downward. On opening the peritoneum, a dilated intestinal coil was seen with other coils collapsed and embedded. The hand of the operator discovered in the upper part of the left iliac fossa a hard tumor, smooth, symmetrical—the nature of which it was difficult to determine. The withdrawal of the intestine was made very easily under the influence of light traction. A loop of intestine withdrawn was œdematous, purplish-red in color, but presenting no trace of constriction. The lumen of the intestine seemed permeable. The tumor perceived in the left iliac fossa at the beginning of the operation now disappeared. Reasoning from this fact, the hypothesis of a hernia in the intersigmoid fossa was advanced and the orifice of this fossa was quickly found; it was about as large as a five franc piece; its walls were infiltrated and dark-colored. The walls of the fossa were also of a purplish color and contained a certain quantity of bloody exudate. It had the appearance of a hollow sphere of sufficient size to hold a mandarin orange. The continuity of the bowel having been re-established, the operation was rapidly completed and the patient returned to his bed. No amelioration of the symptoms, however, followed. By the middle of the next day the patient had not passed any gas or fecal matter and his general condition was very bad. Another laparotomy was done and an artificial anus established. The intestine was, however, completely paralyzed, and the patient died during the night of septic peritonitis. Autopsy revealed nothing new, but enabled the removal of the anatomical specimen which is preserved in the surgical clinic of the St. Sauveur Hospital.

Jonnesco divides retroperitoneal hernia into four classes: (1) Herniæ through the foramen of Winslow. (2) Herniæ in the retroduodenal fossa. (3) Herniæ in the retrocæcal fossa. (4) Herniæ in the intersigmoid fossa.

The intersigmoid fossa has been carefully described by Toldt. Before the time of Toldt the intersigmoid fossa was believed to be situated between the two folds of the mesocolon of the sigmoid flexure,—while in reality, as shown by Toldt, this is very rarely the case, it being usually situated between the parietal peritoneum and the mesocolon. According to Lambret, the orifice of the fossa is best seen by lifting the sigmoid flexure upwards and to the right to a level with the internal border of the psoas muscle, not far from the sacro-iliac synchondrosis and the bifurcation of the common iliac artery. In Lambret'*s case the falsiform fold was found over the orifice.

In the cases thus far observed, the cavity of the fossa has been of variable length, from 3 to 10 cm., in some cases reaching as far as the level of the pancreas. The shape of the cavity varied according to the intestinal contents, to which it always adapts itself. The origin of this fossa has been explained in various ways. Toldt and Jonnesco believe that it is dependent in a large measure upon the influence of the arteries of the mesosigmoid. Lambret believes that the intersigmoid fossa is the result of a particular mode of development of the peritoneum and the folds comprising the mesosigmoid. In brief, he believes that the fossa is due to an interruption in the process of fusion of the mesocolon, the fusion with the parietal peritoneum taking place at a point lower than normal. He believes that the fossa is present in about 80 per cent. of the cases, its protected situation being responsible for the very small number of herniæ that occur in this region.

II. INTRAPARIETAL VENTRAL HERNIA AT MCBURNEY'S POINT.

Mr. X., aged 53 years, had a left inguinal hernia since childhood. Four years ago, his horse fell during a polo match and rolled upon him, injuring the right side of his abdomen. Not very long after this he began to have pains in the region of the right iliac fossa which, it was thought, might be due to some trouble with the appendix.

I first saw the patient in consultation with Dr. W. L. Culbert of New York, in October, 1905. Physical examination at that time showed an oblique irreducible omental scrotal hernia on the left side, and on the right side a direct inguinal hernia about the size of an egg. No tenderness or resistance could be detected over the appendix, and it was believed that the pain and discomfort in the iliac fossa was probably due to the direct hernia which had not been hitherto discovered.

In the latter part of October, 1908, I operated for the double hernia, resected a portion of the omentum on the left side and found a direct hernia of the bladder on the right side. Both wounds were closed by Bassini's method; primary union followed and although the patient has led a very active life, riding and playing polo, there has been no recurrence up to the present time.

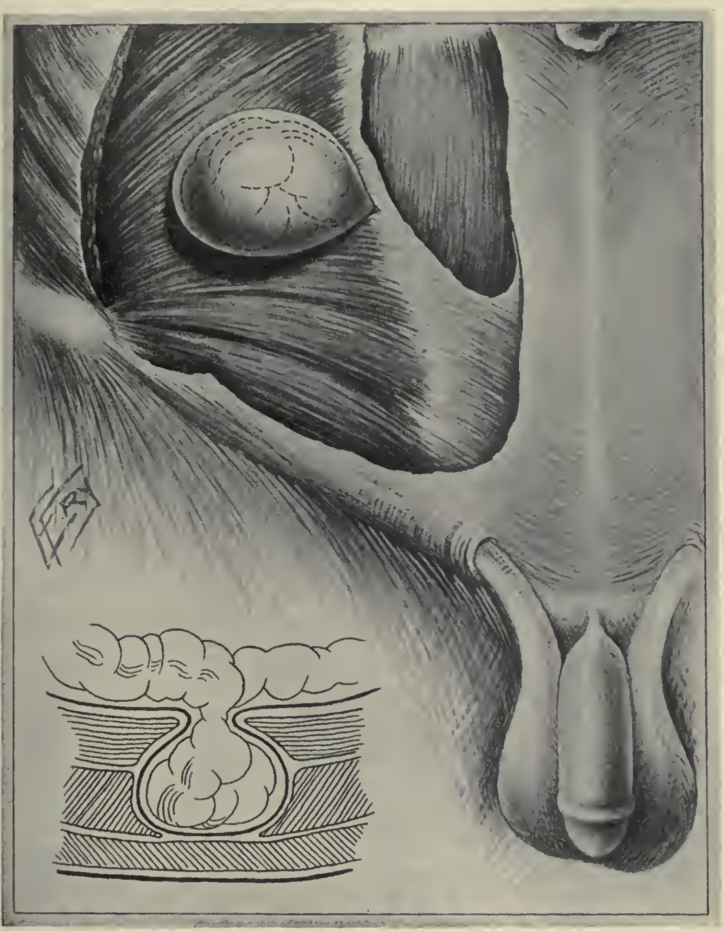
Immediately after his recovery from the operation, he stated that he felt the same pain and discomfort in the right iliac fossa in the region of McBurney's point that he had had before the operation. The trouble was always worse in the latter part of the day, after standing or being on his feet a good deal, and seemed to be relieved by pressure with the hand. I made a number of examinations, but was never able to detect any tenderness or other indications pointing to an inflammation of the vermiform appendix, although the patient localized his pain and discomfort exactly in the region of the appendix. The trouble gradually became more and more annoying and in November, 1908, I made another very careful examination. During this last examination I made the patient cough several times with my fingers pressing directly over the appendix and I then, for the first time, detected a swelling or tumor, apparently beneath the aponeurosis of the external oblique. On pressure the swelling disappeared with exactly the sensation that a hernial tumor gives when its contents slip back into the abdomen under pressure of the finger. The swelling could be made to reappear with the patient's coughing and gave the same sensation on deep pressure. The aponeurosis was apparently normal. Hence the most rational explanation of the phenomenon was that there was an opening through the transversalis fascia and internal oblique muscle of sufficient size to permit the hernial sac to protrude until it reached the aponeurosis of the external oblique. I, therefore, made the diagnosis of interstitial hernia at this point. This diagnosis explained perfectly the pain and discomfort which the patient had so long had in this region and also the gurgling sensations which he stated he had felt from time to time when pressing upon the abdomen in an effort to relieve the discomfort. I advised operation as soon as convenient to the patient. A consultation was first held with three other men. Two of these men were inclined to attribute the condition to intra-abdominal adhesions, while the third thought it was due to a retroperitoneal lipoma rather than a hernia, but all advised operation. I operated upon the patient on January 27, 1909. Incision was made exactly as for an appendicitis operation. The aponeurosis of the external oblique was found intact and very firm. On cutting through the aponeurosis, a tumor about the size of a large goose egg was found. It was of yellowish color, and the outer layer, about one-fourth inch in thickness, consisted of extraperitoneal fat. On cutting through this, a hernial sac, the size of a large hen's egg, presented itself. This was opened and found to contain a loop of the cæcum, which immediately reentered the hernial sac as soon as it was reduced into the abdomen, showing that it had probably occupied this position most of the time, and when it became filled with gas or other contents, caused the pain and discomfort from which the patient had so long suffered. The neck of the sac was situated almost exactly at McBurney's point and the inner side touched the edge of the rectus muscle; it was about seven-eighths inch in diameter and was surrounded by a firm ring of transversalis fascia.

I believe that the hernia was probably of traumatic origin, that a rent in the transversalis fascia was caused four years before at the polo accident and that the hernial protrusion found its way through this shortly afterward, gradually making its way outward through the fibres of the external oblique muscle until its progress was finally checked by the strong layer of aponeurosis. It then enlarged in all directions until it formed a tumor of the size described. There were no adhesions between cæcum and sac. The sac was entirely removed and the transversalis layer and peritoneum sutured by overlapping. The internal oblique muscle was then closed with interrupted sutures of kangaroo tendon; next the aponeurosis and, finally, the skin.

The patient made an excellent recovery and left the hospital at the end of two weeks and has been perfectly well ever since. He has had no return whatever of any of the old symptoms. The size and anatomical position of the sac are well shown in Fig. 3.

The only case that I have been able to find at all similar to the foregoing is the case of Levy, recently reported in the *Beiträge f. klin. Chir.* In view of the fact that in Levy's case there was an undescended or partially descended testicle, there

Fig. 3.



Interstitial hernia at McBurney's point. Sac containing cæcum. (Coley.)

is reason to believe that we have to deal here with one of the ordinary types of interstitial hernia with a bilocular sac, of congenital origin, entirely unlike the case I have described.

I disagree altogether with the statement of Levy that in the absence of complications the treatment of abdominal herniæ due to muscle defects should be mechanical, *i.e.,* that the patient should be fitted with a suitable abdominal support. I believe that all of these cases can be cured by a suitable operation without any risk to the patient. The fact that these cases are peculiarly liable to strangulation should be sufficient ground for advocating operative treatment as a routine measure.

CASE III. RESECTION OF FOUR FEET OF SMALL INTESTINE FOR RECURRENT ATTACKS OF INTESTINAL OBSTRUCTION FOLLOWING REDUCTION EN MASSE OF A STRANGULATED HERNIA FOUR MONTHS BEFORE.

Mr. Y., 53 years of age; has always been in good health. Operated upon for strangulated hernia (by Dr. Foy of Yonkers) in January, 1909; duration of the strangulation 8 hours. A large loop of small intestine was found very dark in color, but as it partially recovered under hot towels was replaced in the abdomen. The patient did very well until three weeks after operation, when he had a slight attack of intestinal obstruction. Had five or six attacks since, sometimes every five or six days; he went one month without any attack; the last very severe attack occurred on May 8. These attacks always began by a localized distention in the left side, which gradually spreads upwards across the abdomen to the right iliac fossa. Vomiting quickly followed and persisted, becoming almost fecal in character. I saw the patient on May 10; he had a movement of the bowels due to strong purgatives and enemas. The abdomen returned to normal and nothing could be felt on palpation. The patient was somewhat weak from the effects of the attack. I believed the condition to be one of adhesions with constriction of the bowel and areas of sloughing. I advised an operation at as early a date as possible. The patient entered the hospital on May 12, 1909, and I did a median laparotomy, assisted by Dr. W. E. Downes. I quickly found two separate loops of bowel joined at a sharp angle by a firm band of adhesions about 1 inch in diameter. These adhesions were cut and the raw surfaces turned in with silk suture. I then came upon a mass about the size of two fists, situated in the middle and a little to the right side of the abdomen; it consisted of five or six coils of small intestine so completely welded together that it was difficult in places to make out the outlines of the separate loops of intestine. It was evident that it would be impossible to separate these adhesions and I decided to resect the entire mass and do a lateral anastomosis. A piece of tape was passed through the mesentery and tied around the healthy portion of the bowel, well beyond the point to be divided. The mesentery was clamped off and sutured by means of fine chromicized catgut. The divided ends of the bowel were inverted and sutured in two layers. The portion removed extended nearly to the ileocæcal valve. A lateral anastomosis was made between the ileum and ascending colon by means of a large Murphy button. Inasmuch as the appendix was found to contain a large, very hard concretion and showed some evidence of congestion, it was removed. The abdominal wound was closed without drainage. Time of operation 1 hour, 15 minutes.

The first two days the patient was given a very small quantity of saline per rectum and a small quantity of water by mouth. On the third day he was given chicken broth and albumin water in one-half ounce portions every 2 hours. The amount of nourishment was gradually increased and at the end of the week he was given solid food. He had very little more reaction than follows an ordinary hernia operation. He passed the button on the eleventh day and was up and about the ward at the end of two weeks. The wound healed by primary union.

The condition of the intestine shows that at the time of reduction the bowel must have been reduced *en masse;* the adjacent loops were so much inflamed that they immediately became adherent and finally welded together in the solid mass seen by the mounted specimen presented.

VESICO-INTESTINAL FISTULÆ.*

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AND

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THE term enterovesical has been employed by many writers, but we have discarded it, because of hybrid Greek and Latin origin, and have adopted the etymologically more correct designation, vesico-intestinal fistulæ, as the title of this paper.

This is a comprehensive term, including all cases where a communication, direct or indirect, exists between the bladder and any portion of the intestinal lumen from pyloric orifice above to anus below. Appendiculovesical fistulæ have not been excluded from this consideration, but no thorough search of the literature has been made for this variety of communication. Some sixty odd cases are, perhaps, to be found scattered through the literature, many of which have not been available for the purpose of this communication. Some are so closely related to the cases under discussion that they have been utilized to illustrate certain phases of the subject.

The literature of vesico-intestinal fistulæ has been quite meager and, with the exception of a few articles, almost inaccessible to English readers. The materials for this paper have been drawn chiefly from Harrison Cripps, who wrote a monograph in 1888, based on 63 cases; Chavannaz, who published an excellent statistical study in 1897 of 95 cases; Kelly and MacCallum, on "Pneumaturia" in 1898; and Pascal, who published his "Doctorate Thesis" in 1900 on "Acquired Vesico-Intestinal Fistulæ," in which he brings the number up to 346 cases, including those of Cripps, Chavannaz and others collected from many sources. To these should be added the interesting case of Jewett's, referred to in Kelly and MacCallum's article.

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* Read before the American Surgical Association, June 5, 1909.

We have searched the literature for cases appearing since 1900 and, as will be seen by the table appended, have added 38 cases, making the total 385 cases to date, including our own, a few conveyed in personal communication, and six cases found in an article by W. Sachs,* of Mullhausen, published in December, 1908.

From the earliest times there are occasional references to communications between intestine and bladder, but the condition was not at all carefully studied until about 1800. The first attempt at collecting and classifying the reported cases appears to have been made by Blanquinque in 1870.

The older writers considered the condition beyond the reach of the art and the first suggestion as to a rational treatment seems to have been made by Barbier de Melle, who, in 1843, believing the site of the fistula always to be in the cæcum, proposed colotomy as a means of cure. Pennell in 1850, and Curling in 1852, were the first to put this procedure into practice, but up to 1870 only six colostomies had been done for vesico-intestinal fistulæ. Pascal claims this as an essentially French operation, but admits that it obtained its greatest success in England.

In 1871 Simon operated on two cases of rectovesical fistulæ, sectioning the sphincter and making a direct suture of the rectal orifice; once with success. Billroth in the same year operated by the same method, but failed to relieve the patient. His observation was not published until 1879.

Dumenil, reporting a case before the French Surgical Congress at Rouen in 1884, highly extolled colostomy, and its popularization as a means of relief of this distressing malady is probably due largely to him.

These two operative principles combined—colostomy and later section of sphincter with suture of fistula—have since been the chief methods for attacking rectovesical fistulæ, until rather recent times.

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* Deutsche Ztschrft. f. Chir., Dec., 1908.

Le Dentu, in 1884, before the Society of Surgery in Paris, suggested suprapubic cystotomy followed by intravesical suture of the bladder opening. This was carried out by Pousson in 1895, with temporary success but ultimate failure, and, as was to be expected, this plan has had few followers. Kelly and MacCallum in 1898, and Reginald Harrison in 1895, enumerate this among the surgical procedures, and one of us in 1897 in a case reported here did the same thing unsuccessfully.

In 1887, Czerny did the first laparotomy, but his patient died. The third and first successful one was done by Boiffin in 1891. Since then the principles of modern abdominal surgery have been freely utilized in such conditions. Cripps, however, writing in 1888 on a basis of 63 cases, takes a gloomy view of the prognosis and is in favor of colostomy rather than laparotomy—or rectal suture.

The best etiological classification seems to be:

- Unknown
- Traumatic
  - Accidental
  - Surgical
- Non-Traumatic
  - Inflammatory, including
    - Abscess
    - Stricture
    - Stone
    - Ulcer
  - Malignant
  - Tuberculosis
  - Syphilis
  - Actinomycosis

Many of the cases, especially the older ones, are so vague that the cause cannot be determined.

The traumatic fistulæ fall into two categories; accidental, by gunshot and stab wounds, falling on stakes, etc., of which the majority are caused by gunshot wounds; and surgical, following the lateral operation for stone, puncture of bladder by rectum, etc. Many such accidents must have followed surgical intervention in former days, but doubtless were not reported.

As a rule fistulæ due to traumatism are developed promptly, but in a minority of the cases they have followed secondarily, either owing to inflammatory action or to the irritation produced by a retained foreign body, bone, etc.

Again, spontaneous cure often follows traumatic fistulæ. Inflammation, cancer and tuberculosis are responsible for the greater number of non-traumatic fistulæ. Rarely one finds actinomycosis or syphilis as the cause.

Pascal, in his Thesis of 1900, gives the following table of non-traumatic cases, classified in this manner:

	Per cent.	No. of cases.
1. Origin in bladder, prostate, vesicles....	18	54
2. Origin in intestine....................	35	105
3. Origin in vicinity of bladder..........	16	48

It is impossible to do more than to give a general picture of the various changes met with at autopsy. The usual findings are those of chronic localized peritonitis, dense adhesions between intestines and intestines and bladder, and masses of indurated thickened tissue, in which may be found cavities containing pus and fæces; to which are added the special features of the causative agent—tuberculosis or neoplasm. Occasionally one finds a simple fistulous tract separating gut and bladder, or again a distinct purulent pouch, into which bladder and intestine empty—the "foyer intermédiare" of Chavannaz.

The bladder is usually contracted, very rarely dilated. Its inner surface, in addition to the abnormal orifice, presents the lesions of chronic cystitis with varied changes in mucous membrane and musculature. Pascal, under the influence of the French school, seems to think that cystitis is not constant, and secondary ascending infection rare. But from the history of the cases and those that we have seen, cystitis seems to be a constant concomitant in some degree, and out of 25 autopsies in which the condition of the kidneys was stated, 18 times they were diseased, and of these 15 were bilateral infections. Of these 18 cases, 6 were due to cancer, 3 to tuberculosis, and 9 to inflammatory processes. Kelly and

MacCallum state that renal symptoms are comparatively rare considering the state of the bladder.

The symptoms are naturally divided into those associated with the primitive lesion, and those dependent upon the fistulous condition. One is struck by the remarkable similarity in the clinical course of the collected cases. One follows another presenting practically the same phenomena, and only differing in causation and unimportant detail.

In the non-traumatic cases there is an antecedent history of intestinal or urinary disease, which ends either abruptly or insidiously by the passage of fecal matter and gas per urethram or liquid stools. As a generality the onset is insidious. Indeed, it is often a distinct surprise to the patient when he suddenly passes gas or fæces. Often the condition is only discovered accidentally, and rarely, though it has been so recorded, one is unaware of this condition.

Once the fistula established there is usually a period of calm, transient or prolonged, then vesical infection ensues and frequent, painful, perhaps, difficult, urination torment the unfortunate. With this there is much mental anxiety and perturbation; digestive troubles, malaise, deterioration in health progressively until the end which comes through general infection or the advancement of the original disease, be it carcinoma or tuberculosis.

Rarely, the patient experiences no discomfort, suffers no impairment of health and lives his life in spite of his condition.

When seen by the physician the prominent symptoms are the passage of gas or fæces per urethram, or liquid uriniferous stools and vesical or rectal disturbances: these suffice to characterize the malady.

It is impossible to read the monographs of Cripps, Chavannaz and Pascal, or to consider the outcome of the collected cases without realizing the gravity of this affection.

In 81 cases which Pascal analyzed he found the mean duration of life, after the appearance of the fistula, to be three years. He also states that out of 300 cases only 19 recovered spontaneously, 15 recovered under expectant treatment, and 24 were cured by operative measures.

Fistulæ situated in the small intestine are unfavorable, as nutrition is interfered with. Those, whose orifices are guarded by papillæ or valves, offer a longer life, as the bladder is partially protected from constant inroads of fecal matter. The amount of disturbance depends largely upon the size of the communicating opening, small perforations oftentimes causing little discomfort. If the urine is passed per rectum rather than fæces per urethram the outlook is much better; and finally any obstruction to urination materially increases the danger as it favors renal infection.

Cancer and tuberculosis appear to be uniformly fatal, when causative agents of this condition.

The complications usually met with are of inflammatory origin or due to secondary calculus deposits in bladder.

While the prognosis is always serious, surgery offers a large hope that the future will see a greatly lessened mortality.

It would seem, at first glance, that the diagnosis of intestinovesical fistula would be easy, but in practice many cases are overlooked at first. The diagnosis to be complete must explain (1) the condition; (2) the cause; (3) the location of the fistula, (*a*) in bladder, (*b*) in intestine; (4) the mode of communication between the viscera, direct or indirect.

The differential diagnosis lies between (1) intestinovesical fistulæ; (2) uretero-intestinal fistulæ; (3) reno-intestinal fistulæ; (4) urethrorectal fistulæ; (5) pneumaturia.

In general, the passage of gas and fecal material by the urethra or liquid uriniferous stools, coupled with the finding of vegetable or animal tissue in the urine, complete the gross picture. Communication between the renal pelvis and intestine, or between ureter and intestine is to be made out by cystoscopic examination, showing (1) Absence of abnormal opening in bladder wall. (2) Seeing cloudy, and especially, fecal urine escaping from an ureteral orifice. (3) Catheterization of the ureters in every case of doubt. Segregation will be of use, but is unreliable, as an opening on one side of bladder might be confused with fecal flow into bladder through the ureter. The cause must be determined by the history, physical examination, tuberculin reaction, examination of urine, etc. Confirmations may be had by the administration of bismuth or charcoal by mouth and their appearance in the urine.

A few words must be said on the question of gas passing per urethram. There are conditions, other than intestino-vesical fistulæ, in which this phenomenon occurs: (1) After instrumental vesical manipulation, litholapaxy, etc. (2) In certain neuropathic conditions. (3) In glycosuric conditions.* These excluded, the passage of gas through the urethra is pathognomonic.

In the bladder the perforation is usually single, occasionally double, very rarely multiple. It is usually small. The position varies, but in almost one-half the cases the abnormal orifice is formed on the base or posterior wall. The summit is the next most frequent position, and only exceptionally the anterior wall. But the location in the intestine is even more important and more difficult to decide on. The site of the opening determines to a great extent the operative measures for relief. Keen's case well illustrates the difficulties attending the definite location of the position of the fistula. The position of the fistula may be ascertained by (1) Cystoscopy. (2) Proctoscopy with digital exploration of rectum. (3) Introduction of plain, colored, or chemical solution or gases via bladder or rectum and their recovery from the opposite organ. (4) Character of food material in urine, as regards the stage of digestion. The elements of the food could be distinguished in Jewett's case indicating location near stomach, afterwards confirmed. By these means the gut can be explored as high as the sigmoid and the bladder in totality. If one is unable to locate the intestinal position of the fistula by these methods, there only remain conjecture and exploratory laparotomy.

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* In Kelly and MacCallum's article on "Pneumaturia," this subject is very thoroughly discussed. Heurry Fenwick also considers it at some length in his work on "Clinical Cystoscopy." See also Dumenil, Rev. de Chir., p. 241; Guignard Jour. des mal. des org. gen., 1883, p. 242.

Chavannaz gives the following percentages indicating the location of the fistulæ: Rectum, 44.44; sigmoid, 24.07; colon, 11.11; colon and ileum, 7.40; appendix, 1.85.

The treatment is either medical or surgical.

Medical: Including rectal and vesical irrigation, local treatment of fistula where possible by curettage and cauterization, urinary and intestinal antisepsis, specific medication, and all measures of general hygiene. Under such regime a certain proportion of cases have recovered; 36 out of 58 recoveries recorded by Pascal.

Surgical treatment may be either palliative or curative. The palliative measures are directed toward the amelioration of the distressing secondary symptoms resulting from stone, stricture, etc. While not designed to cure, this sometimes results in a relief of the condition. The extraction of a stone by lithotomy or lithotrity, the dilating of strictures in a few instances have been followed by healing of a fistula. Under this head may also be placed colostomy, intestino-anastomosis and lumbar transplantation of the ureters. When colostomy is decided upon it is necessary that it should be done so as to fulfil two conditions. First, it must be above the fistula; second, it must be complete, so as to have no connection between the upper and lower segments of the intestine. Moreover, the upper end of the lower segment must be left open and frequent irrigation through and through this segment must be practiced. Ballance lost two cases by closing the lower segment, and Madelung lost two cases where he closed the inferior end and dropped it into the cavity.

Intestino-anastomosis as first practiced by Boiffin and the procedure of Wassilief, or its modification suggested by Lardennois with the Murphy button might be considered in certain rare cases. This procedure of intestino-anastomosis has resulted in cure in a few cases. Intestinorectostomy, intraperitoneal, may be done 7 cm. above the sphincter.

Curative Treatment: Radical treatment has for its object separation of the abnormal openings between intestine and bladder and the restoration of their lumina by separate closure of the openings. The operative approach may be made via (1) the rectum, (2) the perineum, (3) the sacrum, (4) the bladder, (5) the abdomen, or by combination of two or more of these methods. Rectovesical fistula situated within 4½ inches of the anal orifice may be best attacked by one of the perineal operations. This will usually be better than operating through the rectum. The operations of Marion Sims, Desault and others, through the rectum have given good results, and for certain fistulæ low down, are, perhaps to be preferred with, or without, section of the sphincter, primary or secondary. Perineal incision of Zuckerkandl is to be preferred to that of Simon as giving better access. If the suture is made in several layers, the last being of catgut, as suggested by Hugh Young, with suprapubic bladder drainage there will be good chance of success. The anterior transpelvic procedures of Langenbeck, Niehans and Helferich, Ollier and Chalot, are exceptional and will scarcely ever be necessary for closure of these fistulæ. Posterior transpelvic, or sacral operations, however, must be seriously considered in some of these rectovesical fistulæ situated too high for the rectoperineal operation. Of these we should give the preference to the osteoplastic resection. Where more than the coccyx is to be removed the best type of this operation is the Rehn-Rydigier. The transvesical, or intravesical operation suggested by Le Dentu is hardly to be recommended. Only one case, that of Duplay, Case 332, was successful. In one of the cases reported by us it was tried with only temporary success. In another case, that of Fowler, (Case 316), the bladder was merely opened suprapubically and drained, but no attempt was made to suture the fistulous opening in the bladder. Cure followed this simple procedure. All the others, Cases 304, 310, 329, 333, 334, 335, and our own, 378, were either absolute failures or only temporary successes.

Finally the intraperitoneal or transperitoneal operations are to be considered. One of these procedures is to be recommended in all cases where the milder operations have been either tried or are clearly inapplicable. Exploratory laparotomy often affords the only reliable means of informing one's self thoroughly as to the true condition and its cause, and enables the surgeon to decide upon the best procedure from actual observation. Then, too, if nothing can be done, it may be easily terminated by the palliative operation of colostomy. If the point of adhesion or communication can be found and separated, the radical operation is the procedure of choice. In some cases it may be advisable to close only the intestinal opening, draining the intermediary pouch, or sometimes a simple drain may be put in, without closure of either opening. One case is reported cured in this way. (Terrier, Case 301.) If the adhesions are such as to make it impracticable to separate the viscera, the radical operation may have to be abandoned and intestino-anastomosis, or bilateral exclusion of the involved intestinal loop, or colostomy done as a last resort.

Sachs, in *Deutsche Zeitschrift für Chir.*, December, 1908, reports a case in which he successfully operated by excluding totally the portion of involved intestine, 15 cm. in length, turning in both ends of this, and re-establishing the intestinal continuity by end-to-end approximation with Murphy button. This procedure, the suggestion of which he credits to Salzer * has been carried out in only one other case, that of Eiselsberg (Case 384) which died five days after operation. While so brilliantly successful as in Sachs' case, it nevertheless is open to such serious objection that we must agree with Payr in asking yet more light upon the later course of cases so treated, before we can give it our unreserved endorsement. It is true that cases like those of Bryant and Harrison, in which autopsy some years subsequent to a colostomy for rectovesical fistula showed complete obliteration of all that part below the artificial anus, afford justification for the operation of complete intestinal exclusion as done by Sachs, but, as he points out, we cannot always be sure that urine or natural secretion in the excluded section may not accumulate and furnish a positive menace to life. Where the communication is with the lower part of colon, sigmoid or rectum, the flow of urine into the bowel is made evident by its escape from the anus;

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* "Festschrift Billroth," p. 536.

in such cases one would hesitate to resort to this operation of complete intestinal exclusion. Further, in cases of high intestinal involvement one may never be sure that there is no flow of urine from bladder to intestine, because even where it does occur it may be absorbed or be so mixed with fæces as not to be apparent in the stools. It would seem, then, until further investigation is made, that complete intestinal exclusion should only be carried out in those cases where we may be reasonably sure that the flow is only in the direction of the bladder, not from it into intestine. We think, with Sachs, that this problem calls for experimental investigation in animals to determine in how far bilateral, or complete, intestinal exclusion may be considered a safe surgical procedure.

CONCLUSIONS:

1. Establish clearly the nature of the lesion.

2. Determine the location of the opening in the bladder and in the intestine, when possible; this can usually be done by the modern methods of exploration of the rectum and bladder, and by a study of the intestinal contents passed per urethram.

3. Medical treatment is always to be tried for a reasonable time, as some cases have recovered under such management, and certain fistulæ of syphilitic origin have been absolutely cured by appropriate treatment.

4. The prognosis of cases untreated is generally bad and spontaneous cures are rare.

5. Ascending infection of the kidneys is one of the most important sequellæ, and this is always to be feared in cases that do not recover within a reasonable time.

6. Colostomy relieves the symptoms though it does not cure the condition, but is to be tried in all cases where a radical procedure is not possible.

7. Radical operation is always to be preferred when practicable; from below, when the fistula is situated within 4½ inches of the sphincter in suitable cases; intraperitoneally, for high-placed fistulæ, the viscera being separated and direct suture of each opening done.

8. Where the radical operation cannot be done, bilateral

or total exclusion of the portion of intestine involved, as practiced by Sachs in Case 385, may be done when there is no urinary flow into the bowel; this not being advisable, one of the shunting anastomosis procedures should be done, or simple drainage of an intermediary pouch resorted to.

9. The suprapubic intravesical suture of the bladder orifice is not to be recommended, because difficult of execution and uncertain in result.

10. Exploratory laparotomy is indicated in all cases in doubt to determine the location of the fistula and the operation of choice. Colostomy is to be regarded as an operation of last resort and applicable only in those cases where the artificial anus may with certainty be placed above the fistulous communication with the bladder.

Dr. Parham's Case of *Vesicorectal Fistula.*

J. L., 48 years of age, a native of Louisiana, consulted me in 1895, complaining of great irritability of bladder due to the passing of fecal matter.

Family history: Father died of pneumonia at the age of 52, mother died at age of 27, shortly after his birth. Both grandfathers died about the age of 60. Does not know anything of grandmother. One sister and two brothers are living and in good health, one half brother by father died of lung trouble at age of 36, one sister died at 52 years of heart trouble, two half sisters of yellow fever.

Personal history: Has been much afflicted with fevers since childhood, periodical in character. In 1889 had severe jaundice with stomach trouble. Had measles and whooping cough when a child. No history of chronic cough. Twenty-five years ago had severe dysentery lasting a month.

History of present disease: In October, 1892, suffered with constipation and pains in lower part of abdomen on left side, accompanied by frequent micturition, followed after each urination by burning sensation in the urethra. This continued about three weeks, when he took 10 grains of calomel followed by Epsom salts. Violent pains in lower abdomen attended the purgative action. In November, 1892, being still much troubled, he came to New Orleans and was treated by Dr. Chassaignac for two months. He thinks he passed some bowel contents occasionally by urethra during this time, attended by much bladder disturbance. He went home much improved. Four months later he was so much better he was able to resume his duties as road and levee inspector in his country district, although he would have at times more or less bowel and bladder disturbance.

In November, 1893, he had an attack of dysentery, and was much worse with his urinary troubles. He came to New Orleans and was again under Dr. Chassaignac's care for three weeks. Under this treatment he improved and was well as before. He thinks he passed occasionally some fecal matter. After this, he continued to improve, the symptoms all disappearing except the frequent urination. He got much stronger and would have considered himself well, but for the occasional pains in the lower abdomen on the left side. He seems to have remained well for a long time after this, but in June, 1895, he became ill again with fever, colic in the lower abdomen, left side especially, followed some hours later by the passage of gas and fecal matter per urethram. He entered the Charity Hospital and was treated by Dr. Brickell for four weeks. Under treatment he improved very much. He would frequently urinate fecal matter. During constipation he would not pass fecal matter by urine for sometimes three or four days. He went home in June, 1895. In November, the symptoms of his old malady returned in aggravated form, preceded by diarrhœa. Fecal matter came now in increased quantity with the urine. This condition of things continued until his admission to my service at the Charity Hospital on November 18, 1895. His condition at this time was as follows:

Has lost much flesh, though not emaciated. General appearance good, complexion clear with slight conjunctival injection and some jaundice. Tongue fissured and slightly coated. Has good appetite and would sleep well were he not disturbed by frequent urination. Temperature, pulse and respiration normal.

Examination of abdomen, rectum and urinary organs: Somewhat constipated but consistence of passages normal. Has had no diarrhœa since his admission. Belly-wall loose and not retracted. Nothing revealed by palpation, except slight tenderness over region of bladder. In left inguinal region nothing, but in right inguinal region a reducible scrotal hernia. On standing right side of scrotum filled well with the descended bowel.

History of this hernia: Has been present as long as he can recollect. Always suffered more or less, but never wore a truss until 1883, when one gave him considerable relief. In November, 1893, the truss being old had to be drawn very tight, but he is not sure that this had anything to do with the pains which came on in the lower abdomen.

November 30, 1895: Filled bladder with sterilized fuchsin solution; none came into rectum. Then emptied bladder and filled with uncolored fluid and threw methyl blue solution into rectum and allowed the bladder to empty through a catheter introduced, the patient being in knee-elbow position. No bluish coloring of the water was observed. Digital examination of rectum revealed moderately enlarged prostate, tender. Several hours afterwards a chill followed by fever to 103 degrees.

December 6: Is passing fecal matter freely, fecal odor, no undigested particles. Bowels have been somewhat disturbed during the night.

December 29: Assisted by Drs. Chassaignac, Matas, Martin and Delaup, I opened the abdomen in the middle line below the umbilicus. The upper part of the rectum and lower part of the sigmoid was adherent on the bladder wall. A large, hard mass could be felt here. We concluded it was an inoperable neoplasm and closed the abdomen.

January 13, 1896: Fecal matter is passing in increased quantity.

February 4, 1896: The condition being aggravated and radical operation being out of the question, I did an inguinal colostomy in two stages, the second stage being completed by the formation of the artificial anus three days later. The section of bowel was complete.

February 9, 1896: The stitches were all removed and the anus was well established. The lower segment of bowel was irrigated daily. Amelioration of the bladder symptoms was prompt and decided.

February 17, 1898: I determined now to make an effort to close the bladder opening and, if successful, to restore the continuity of bowel, where broken by the artificial anus.

Accordingly, on February 17, 1898, at the New Orleans Sanitarium, I opened the bladder above the pubic symphysis. I found the opening without much difficulty on the superior wall and sutured it with catgut, inserting four sutures. Dawbarn's intermittent siphonage was employed to protect the line of suturing.

(In another case I should use a de Pezzer catheter per urethram.) For a time it seemed that we would succeed, but the sutures gave way and the opening became re-established. The suprapubic wound gradually healed and he was allowed to go back to his home in the country, no further effort being made to close the bladder fistula.

I have not seen him now for many years but have occasional letters from him. He wrote me during May of last year, reporting himself as comfortable and enjoying good health. The artificial anus is easily managed, giving him little inconvenience except when bowels are loose.*

DR. HUME'S CASE. Mr. H. H., M. W., aged 39 years, married; has 5 children. Jan. 22, 1908: complaint, pus in urine and bladder trouble.

Family history: Two uncles, paternal, died of T. B. Past history: Mumps as a child, no orchitis. Malaria, no hæmaturia with it. Some inflammation of bowels 10 years ago. Does not know what it was; some thought it appendicitis; was in bed one month. General health good; constipated; average weight 153 pounds; 8 to 10 pounds below it now. Venereal history: Soft sore 20 years ago; no secondaries. Denies gonorrhœa.

Present illness: Patient well till one year ago. Then, when in a malarial attack, his urine was examined and pus was found in it, also albumin. Since then seen by several doctors who considered he had kidney trouble, probably tuberculosis. Patient has no symptoms save from frequency of urination and a "sputtering," as if air was in his urine, on urination. Every two to four weeks he gets depressed, feels drowsy, occasionally has chill with fever. Has pain in back low down in middle of spine. He is then sick with fever for a few days, and his urine seems worse at such times. He has had these attacks for twenty years, five or six a year at first, later every two to six weeks. Duration one to eight days. Considered as malarial or bilious attacks and treated by purging.

Examination.—Patient, well-built male; prematurely gray and aged to eye. Tongue furred. Thorax negative, abdomen negative save for slight pain in (1) left iliac fossa, (2) right

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* It is not infrequently true that a mass suspected after abdomen is open to be malignant, is proven, as in this case, by the lapse of time to be merely inflammatory infiltration (see also Mayo's article on Diverticulitis).

TABLE OF CASES

u x r = Urine by rectum.
f x u = Fæces by urethra.
rf = Either or both ways.
F. I. = Foyce intermédiare.
A. = Autopsy.
2 I = Two orifices in intestine.
2 B = Two orifices in bladder.

No.	Age and Sex	Cause	Location and number	Urine and Fæces	Treatment	Result	Duration
1	M	......	......	u x r	......	......	12 yrs.
2	M	Cancer of rectum	Rectum and bladder-neck. 1	f x u	......	Autopsy	
3	M 12	......	......	u x r	......	Recovery	
4	M 80	Cancer of bladder	Rectum and bladder. 1	f x u	Medical	Death	3 mos.
5	F	Traumatic	......	u x r	......	......	......
6	M 50	Cutting for stone	Rectum and bladder. 1	u x r	Medical	A., cancer of Bladder	......
7	M	......	......	u x r	......	Recovery	......
8	M	......	......	f x u	......	A., ulceration of bladder	......
9	M	......	......	u x r	......	A., cancer of bladder-neck	......
10	M	......	Bladder and rectum	u x r	......	A., ulceration found	......
11	M	Stone (?)	......	f x u	......	......	......
12	M	Gonorrhœa (?)	Rectum and bladder	u x r	Medical	Failure	......
13	M 50	Stone	......	f x u	......	Death	6 mos.
14	M	......	Colon and bladder	f x u	......	A., abscess in left iliac fossa	......
15	M 60	Stone	(Kidneys diseased)	f x u	......	Autopsy	......
16	M 7	Traumatic	......	u x r	Medical	Recovery	......
17	M 69	Stone	Rectum and bladder	u x r	Medical	Death	......
18	M 50	Cancer (?)	......	u x r	......	A., rectum not examined	......
19	M	......	......	u x r	......	Death	......
20	M	Ulceration	Rectum and bladder	u x r	......	......	......
21	M	......	......	f x u	......	Death	......
22	M 50	......	......	u x r	......	Death	......

23	M 73	Stricture of sigmoid	Colon and bladder. F. I. (Kidneys diseased.)	f x u	Medical	Autopsy	......
24	F	Cancer (?)	......	rf	......	Death	3 mos.
25	M 60	......	Colon and bladder	f x u	......	Autopsy	8 mos.
26	......	Stone (?)	......	u x r	......	Recovery (?)	......
27	M 63	Ulcer of rectum	......	u x r	......	......	......
28	M 62	Stricture (?)	Ileum and bladder	f x u	......	Autopsy	1 mo.
29	M 60	Traumatic. Puncture of bladder by rectum	Rectum and bladder	u x r	......	......	10 yrs.
30	M	Traumatic. Puncture of bladder by rectum	......	u x r	......	A., Suppurated	11 da.
31	M 50	Stricture of rectum	......	f x u	......	Death	5 mos.
32	M 50	Abscess between bladder and rectum	......	f x u	Medical	Recovery	......
33	F 24	Inflammation	Sigmoid and bladder. F. I	f x u	......	Autopsy	1 mo.
34	M 6	Cutting for stone	......	u x r	......	Not cured	......
35	M 14	Cutting for stone	......	u x r	......	Death, peritonitis	6 da.
36	M 16	Gun shot. Traumatic	Rectum and bladder	u x r	......	......	30 da.
37	M 60	Cancer (?)	Colon and bladder	f x u	......	Autopsy	......
38	F 59	Stricture	Sigmoid and bladder	f x u	......	Autopsy	5 mos.
39	M 53	Inflammatory	Rectum and bladder	u x r	......	Autopsy	......
40	M 76	Inflammatory	Sigmoid and bladder F. I.	rf	......	Autopsy	1 mo.
41	F 27	Child-birth. Inflammatory	Rectum and bladder	f x u	......	Autopsy	3 mos.
42	F 19	Child-birth	Rectum and bladder	......	......	......	......
43	M	Tubercular (?)	Colon and bladder. F. I.	f x u	......	Autopsy	2½ mos
44	M 60	Cancer	Colon and bladder	f x u	......	Autopsy	4 yrs.
45	M 60	Inflammatory	Rectum and bladder	u x r	Medical	Recovery, cured	2 mos.
46	F	Cancer	Rectum and bladder	f x u	......	Autopsy	......
47	......	......	Rectum and bladder	f x u	......	......	......
48	......	Stone	Rectum and bladder	......	......	......	......
49	M 65	Cancer	Sigmoid and bladder	f x u	......	Death	......

TABLE OF CASES—*Continued*

No.	Age and Sex	Cause	Location and number	Urine and Fæces	Treatment	Result	Duration
50	M 7	Stone (?)	Ap. and bladder. 2B. (Kidneys diseased).	f x u	....	Death	8 mos.
51	F 65	Cancer	Ileum and bladder	f x u	....	Death	4 yrs.
52	F 42	Syphilis	Rectum and bladder	u x r	....	Autopsy	....
53	Child	....	Rectum and bladder	u x r	....	....	....
54	....	Stricture	Rectum and bladder	f x u	....	....	....
55	....	....	....	f x u	Colotomy	Lived 5 months	....
56	F 68	Ileum and bladder	....	f x u	....	Death	....
57	M 62	Stricture	Colon, rectum, ileum, and bladder	f x u	....	Autopsy	....
58	....	Stricture of sigmoid	Colon and bladder	......	....	....	....
59	M 38	Traumatic	Rectum and bladder	f x u	Medical	Autopsy	17 da.
60	M 50	Puncture of bladder	Rectum and bladder	u x r	Medical	Improvement	....
61	M 64	Traumatic	Jejunum and bladder (Kidneys diseased?)	......	....	Autopsy	....
62	....	Abscess	Rectum and bladder	......	....	....	....
63	F 23	....	Rectum and bladder	f x u	....	Death	....
64	F	Abscess of ovary (?)	Sigmoid and bladder. F.I. (Stone in kidney.)		....	Death	....
65	F 35	Inflammatory	Appendix, cæcum and bladder. F. I.	f x u	....	Autopsy	....
66	M 40	Inflammatory	Colon and bladder	f x u	....	Autopsy	6 mos.
67	F	....	Colon and bladder. 2 I. F. I.	......	....	....	3 wks.
68	F 54	....	Bladder, sigmoid and ileum	rf	....	Autopsy	3 yrs.
69	F	Child-birth	Rectum and bladder	f x u	....	Autopsy	....
70	....	Cancer of cæcum	Cæcum and bladder		....	Autopsy	....
71	....	Tuberculosis (?)	Sigmoid and bladder	f x u	....	Autopsy	.....

72	M	Inflammatory	Rectum and bladder. (Kidneys diseased.)	......	....	....	......
73	M 25	Stricture of rectum	Rectum and bladder	f x u	....	Autopsy	2 yrs.
74	F 45	....	....	f x u	....	Improved	......
75	M	....	....	f x u	....	Improved	......
76	M 64	Stricture of sigmoid	Sigmoid in bladder	f x u	....	Death	......
77	M	Stone (?)	....	rf	....	Improved	......
78	M	Urethral stricture	....	f x u	....	....	......
79	M 79	Stricture of urethra (?)	....	f x u	....	Death	1 mo.
80	M 44	T. B. of prostate and stricture of urethra	Rectum and bladder. 2 B. (Kidneys diseased)	u x r	....	Autopsy	......
81	F 18	Inflammatory	Cæcum and bladder. F.I.	f x u	....	Autopsy	......
82	M 37	....	....	f x u	....	....	......
83	M 33	Tuberculosis	....	f x u	....	Death	......
84	M 56	Stricture of sigmoid	Sigmoid and bladder. F.I	f x u	operation, colotomy	Autopsy after operation	17 da.
85	F	Inflammatory	....	f x u	....	Recovery	......
86	33	Tuberculosis (?)	....	f x u	....	....	......
87	59	Abscess	Large intestine and bladder	f x u	....	Autopsy	......
88	F 20	....	....	u x r	....	Recovery	......
89	F 43	Abscess	Ileum and bladder. (Kidneys congested)	f x u	....	Autopsy	2 mos.
90	56	....	Rectum and bladder	f x u	....	Death	5 mos.
91	M 35	....	....	f x u	....	Death	14 yrs.
92	......	....	....	......	....	Death	......
93	54	Cancer of rectum	Rectum and bladder	f x u	....	Autopsy	2 wks.
94	M	Tuberculosis	Cæcum and bladder. 2B.	f x u	....	Autopsy	6 wks.
95	M old	Obstruction	....	f x u	....	Death	22 yrs.
96	F 48	Inflammatory and tubercular	Cæcum and bladder. F. I. (Right kidney diseased.)	f x u	....	Autopsy	......
97	F 28	Cancer (?)	Large intestine and bladder	rf	....	....	......

TABLE OF CASES—*Continued*

No.	Age and Sex	Cause	Location and number	Urine and Fæces	Treatment	Result	Duration
98	M 43	Abscess	Cæcum, ileum and bladder. F. I.	f x u	......	Autopsy	......
99	M 60	......	Appendix and bladder	f x u	......	Autopsy	......
100	M 42	Syphilis (?)	Rectum and bladder	......	......	......	......
101	M 3½	Cutting for stone	......	......	......	Recovery	10 da.
102	M	......	......	f x u	......	......	......
103	F	......	......	......	......	......	......
104	F	......	......	f x u	......	......	......
105	......	......	......	f x u	......	......	......
106	M	Inflammatory	......	f x u	......	Recovery	12 da.
107	(This	number omitted in	Pascal)	......	No case	......	......
108	F 57	Inflammatory	......	f x u	......	Death	......
109	F 15	Tuberculosis	......	f x u	......	......	......
110	35	Obstruction	......	......	......	Death	......
111	......	Abscess	......	f x u	......	Death	......
112	M 32	Abscess of prostate; tuberculosis	Rectum and bladder. (Kidneys diseased)	rf	......	Autopsy	......
113	F	Cancer of rectum	......	u x f	Operation, colotomy	Death	......
114	M 85	Ulceration of rectum	Large intestine and bladder	f x u	Operation, colotomy	Death	......
115	M 51	Ulceration	Sigmoid, cæcum and bladder	rf	Operation, colotomy	Autopsy	......
116	M 55	Cancer of bladder	Rectum and bladder	rf	......	Autopsy	......
117	M 37	......	......	f x u	......	......	......
118	M 8	Inflammatory	Appendix and bladder F. I.	u x r	Operation for stone	Autopsy	......
119	F	Inflammatory	Bladder and intestine and skin	......	......	......	......
120	M 35	......	......	u x r	......	Death	......

121	M 44	Tuberculosis	Cæcum and bladder. F. I.	f x u	......	Autopsy	7 mos.
122	... ..	Rectal ulceration	Rectum and bladder	u x r	......	......	......
123	......	......	Rectum and bladder	......	Bougie	Improvement	......
124	F	T. B. or Lues	Rectum and bladder. F. I. 2 R (Kidney diseased).	......	......	Autopsy	......
125	M 40	Inflammation	Rectum and bladder	f x u	Local	Recovery	......
126	M	Inflammatory	Colon and bladder	f x u	Suture of fistulæ by rectum	Suicide; autopsy	26 yrs. after.
127	F 41	Cancer of uterus	Rectum and bladder. F. I.	......	......	Autopsy	......
128	F 69	Cancer of uterus	Rectum and bladder	......	......	Autopsy	......
129	F 63	Cancer of uterus	Rectum and bladder	......	......	Autopsy	......
130	F 45	Cancer of uterus	Rectum and bladder	......	......	Autopsy	......
131	F 59	Cancer of uterus	Rectum and bladder	......	......	Autopsy	......
132	F 52	Cancer of uterus	Rectum and bladder. (Right kidney, cancer)	......	......	Autopsy	......
133	F 43	Cancer of uterus	Rectum and bladder	......	......	Autopsy	......
134	M 62	Cancer of rectum	Rectum and bladder	......	......	Autopsy	......
135	M 61	Cancer of bladder	Rectum and bladder	......	......	Autopsy	......
136	M 60	Rectal stricture	Rectum and bladder	......	Colotomy	Death	......
137	M 60	Rectal ulceration	Rectum and bladder	......	Colotomy	Death	......
138	M 59	Ulceration	Sigmoid and bladder	......	Colotomy	Death	......
139	M 20	Stricture of rectum	Rectum and bladder	rf	Colotomy	Improvement	......
140	M	......	Colon and bladder	f x u	......	Autopsy	......
141	M 79	......	......	f x u	......	Death	......
142	M 65	......	Colon and bladder. F. I. (Kidneys diseased.)	u x r	......	Autopsy	......
143	M 44	Inflammatory	Rectum and bladder	f x u	......	Improvement	......
144	M 44	Traumatic	Rectum and bladder	u x r	Operation for stone	Death	......
145	M 54	Cancer of rectum	Rectum and bladder	rf	Colotomy	Death in 6 weeks	......

TABLE OF CASES—*Continued*

No.	Age and Sex	Cause	Location and number	Urine and Fæces	Treatment	Result	Duration
146	M 55	Traumatic; rectal puncture	Rectum and bladder	u x r	External urethra	Improvement	....
147	M 60	Inflammatory (?)	Colon and bladder	f x u	....	Autopsy	....
148	M	Tubercular	Rectum and bladder	......	Operation	Autopsy	....
149	M	Traumatic	Rectum and bladder. 4 B. F. I.	u x r	Operation for stone	Autopsy	....
150	M 30	Traumatic. Bullet wound	Rectum and bladder	......	....	Autopsy	....
151	M	....	....	f x u	....	Improved	....
152	M 72	....	Colon and bladder	......	....	....	....
153	M	Traumatic	Colon and bladder	......	....	....	....
154	M 25	....	....	f x u	....	Death	....
155	M 49	Rectum ulceration	Rectum and bladder	f x u	Colotomy	Recovery	....
156	F 55	Inflammation	Rectum and bladder	f x u	Opening of abscess	Recovery	....
157	F 23	Pelvic abscess	Rectum and bladder	f x u	....	Death	4 yrs.
158	F	Ovarian abscess	Sigmoid and bladder. F. I.	f x u	....	Autopsy	1 yr.
159	M	Gunshot wound	Rectum and bladder	......	Division of sphincter	Recovery	....
160	F	Child-birth	Rectum and bladder	......	....	....	....
161	M 27	Gunshot wound	Rectum and bladder	u x r	Catheter	Improvement	....
162	M 40	Traumatic	Rectum and bladder	u x r	Medical	Recovery	....
163	M 27	Tuberculosis (?)	Rectum and bladder	rf	Colotomy	Death in 3 weeks	....
164	M 52	Inflammatory	Colon and bladder	f x u	....	Autopsy	....
165	M 58	Cancer of rectum	Rectum and bladder	rf f x u	Colotomy	Death	....
166	M 60?	Cancer of rectum	Rectum and bladder	rf	Colotomy	Death	....
167	F	Child-birth	Rectum and bladder	f x u	Colotomy	Recovery	....
168	......	....	....	f x u	....	Death	....
169	......	....	Colon and bladder	......	....	Autopsy	....

170	76	......	Cancer of sigmoid	f x u	......	Autopsy	......
171	F	Child-birth	Rectum and bladder F.I.	......	......	Autopsy	......
172	M 50	Inflammatory stricture of rectum	Rectum and bladder. F. I.	f x u	......	Autopsy	......
173	M 60	......	Colon and bladder	f x u	......	Death	......
174	M 58	Cancer of colon	Colon and bladder. (Kidneys diseased)	f x u	......	Autopsy	......
176	M 67	Stricture	Sigmoid and bladder. 2 B. F. I.	f x u	......	Autopsy	......
177	M 16	Traumatic	Rectum and bladder	u x r	Medical	Recovery	......
178	M 46	Traumatic	Rectum and bladder	......	Medical	Recovery	......
179	M	Traumatic	Rectum and bladder	f x u	Catheter	Recovery	......
180	M	Traumatic	Rectum and bladder	......	......	Recovery	......
181	M 55	Traumatic	Rectum and bladder	......	......	Recovery	......
182	M	Traumatic	Rectum and bladder	......	Operation for secondary stone	Recovery	......
183	M	Gunshot wound	Rectum and bladder	......	......	Recovery	......
184	M	Gunshot wound	Rectum and bladder	......	......	Recovery	......
185	M	Gunshot wound	Rectum and bladder	......	......	Recovery	......
186	M	Gunshot wound	Rectum and bladder	......	......	Recovery	......
187	M	Gunshot wound	Rectum and bladder	......	......	Recovery	......
188	M	Gunshot wound	Rectum and bladder	......	Catheter	Recovery	......
189	M	Gunshot wound	Rectum and bladder	......	......	Recovery	......
190	M	Gunshot wound	Rectum and bladder	......	......	Recovery	......
191	M	Gunshot wound	Rectum and bladder	......	......	Fistula persisted	......
192	M 23	Gunshot wound	Rectum and bladder	......	Secondary operation for stone	Recovery	......
193	M	Gunshot wound	Rectum and bladder	......	Catheter	Recovery	......
194	M	Gunshot wound	Rectum and bladder	......	......	Recovery	......
195	M 26	Gunshot wound	Rectum and bladder	......	......	Recovery	......
196	M 35	Gunshot wound	Rectum and bladder	......	......	Fistula persisted. Death	13 mos.
197	M	Gunshot wound	Rectum and bladder	......	......	Recovery	......
198	M 34	Gunshot wound	Rectum and bladder	......	Secondary operation for stone	Fistula persisted	......
199	M 30	Gunshot wound	Rectum and bladder	......	......	Fistula persisted	8 yrs.

TABLE OF CASES—*Continued*

No.	Age and Sex	Cause	Location and number	Urine and Fæces	Treatment	Result	Duration
200	M	Gunshot wound	Rectum and bladder	......	....	Fistula persisted	....
201	M	Gunshot wound	Rectum and bladder	......	....	Recovery	....
202	M	Gunshot wound	Rectum and bladder	......	....	Recovery	....
203	M 29	Gunshot wound	Rectum and bladder	......	Secondary operation for stone	Recovery	....
204	M	Gunshot wound	Rectum and bladder	......	....	Recovery	....
205	M	Gunshot wound	Rectum and bladder	......	....	Death	....
206	M	Gunshot wound	Rectum and bladder	u x r	....	Death	27 da.
207	M 27	Gunshot wound	....	......	....	Recovery	....
208	M 22	Gunshot wound	Rectum and bladder	......	....	Fistula persisted	....
209	M 39	Gunshot wound	Rectum and bladder	......	....	Fistula persisted	....
210	F	Gunshot wound	Jejunum and bladder	......	....	Autopsy	....
211	M 23	Traumatic	....	rf	Secondary operation for stone	Recovery	....
212	M 26	Tuberculosis	Large intestine and bladder. F. I. (Kidneys healthy).	f x u	....	Autopsy	....
213	F 52	Inflammatory	Duodenum and bladder	f x u	Cauterization of bladder orifice	Recovery	....
214	M	Operation for stone	Rectum and bladder. (Bright's disease)	u x r	Division of sphincter twice	Death	....
215	......	Inflammation (?)	Rectum and bladder	......	....	....	....
216	M	Traumatic	Rectum and bladder	f x u	....	Autopsy	....
217	M 70	....	....	f x u	....	....	....
218	M	Typhoid fever (?)	Colon and bladder	f x u	....	....	8 yrs.
219	M	T. B. (?)	Colon and bladder	f x u	....	....	....
220	......	....	....	f x u	....	....	....
221	M	Cancer of prostate	Rectum and bladder	u x r	....	Recovery (?)	....
222	M 28	Operation for stone	....	......	....	....	....

223	M 53	Cancer of rectum	......	f x u	Colotomy	Recovery	......
224	F	Inflammation following child-birth	Intestine and bladder. 2 B. (Kidneys normal.)	f x u	......	Autopsy	2½ yrs.
225	F 50	Stone	Colon and bladder	f x u	Operation	Improvement	......
226	F	Stone	......	rf	Operation	Recovery	......
227	M 4	Sarcoma of ileum	Ileum and bladder	f x u	......	Autopsy	......
228	F	Tumor of uterus	Colon and bladder	......	......	Death from T. B.	......
229	F	Inflammatory	Large intestine and bladder	f x u	......	......	......
230	M 27	Stricture of rectum	Large intestine and bladder	......	Colotomy, rt.	Autopsy 10th day	16 mos.
231	F	Child-birth	Rectum and bladder	f x u	......	Recovery	......
232	F 25	Child-birth	......	f x u	Colotomy	Death	......
233	F 30	Inflammatory	Colon and bladder. F. I.	f x u	Colotomy	Autopsy	......
234	M 50	......	......	f x u	......	Improvement	......
235	M	......	Rectum and bladder	......	Catheter; sphincter cut	......	......
236	M 69	Tuberculosis	Ileum and bladder	f x u	......	Autopsy	......
237	M 85	Ulceration	Rectum and bladder	f x u	......	Autopsy	......
238	......	Cancer	Rectum and bladder	f x u	......	Autopsy	6-7 mos.
239	......	Cancer	Rectum and bladder	......	......	Autopsy	2 yrs.
240	......	Cancer	Rectum and bladder	......	......	Autopsy	......
241	M 79	Inflammatory	Rectum and bladder	u x r	......	Autopsy	......
242	......	Cancer	Rectum and bladder	......	......	Autopsy	......
243	......	Ulceration	Rectum and bladder	......	......	Death. Specimen	......
244	......	......	Rectum and bladder	......	......	......	......
245	M 22	Traumatic	Rectum and bladder	rf	Operation, stone removed; suture	Recovery	......
246	......	Operation for stone	Rectum, bladder and urethra	......	......	......	......
247	......	Operation for stone	Rectum, bladder and urethra	......	......	......	......
248	......	......	Sigmoid and bladder. F. I. 2 B	......	......	Autopsy	......

TABLE OF CASES—*Continued*

No.	Age and Sex	Cause	Location and number	Urine and Fæces	Treatment	Result	Duration
249	......	Ulceration	Rectum and bladder. 5 R	......	......	Autopsy	......
250	......	Stricture of sigmoid	Colon and bladder	f x u	......	Autopsy	......
251	M	Gunshot wound	Rectum and bladder	f x u	......	......	......
252	M 33	Cancer of bladder	Colon and bladder	f x u	......	Autopsy	......
253	M 23	Traumatic	Rectum and bladder	u x r	Sphincter cut	Improvement	......
254	M 44	Stricture of sigmoid	Rectum and bladder. (Kidneys diseased). 3 R	f x u	Sphincter cut; fistula explored	Autopsy	......
255	M 52	Tuberculosis of prostate	Rectum and bladder. (Right kidney healthy left T. B.)	u x r	......	Autopsy	......
256	M	......	Rectum and bladder	......	......	Not cured	......
257	......	Operation for stone	......	......	Operation	Recovery	......
258	......	Traumatic	......	......	Operation	Recovery	......
259	M 48	Inflammation	Colon and bladder. (Kidneys diseased)	f x u	Laparotomy; suture; colotomy	Autopsy	......
260	M	Stone	Rectum and bladder	......	Operation	Recovery with repeated cauterization	......
261	M 69	Cancer of prostate (?)	Rectum and bladder	f x u	......	Death	......
262	M 50	Cancer of rectum	......	f x u	Colotomy	Death	......
263	F 69	......	......	f x u	......	Improvement	
264	F 50	Cancer of rectum	Ileum, colon and bladder	f x u	......	Autopsy	......
265	......	Traumatic	Rectum and bladder	f x u	Sphincter cut, no catheter	Recovery	......
266	F 25	Inflammatory (?)	......	f x u	Medical	Improvement	......
267	F	Perityphlitis	......	......	Operation		......
268	......	Sarcoma of bladder	......	......	......	......	......
269	M 41	Appendicitis	Colon and bladder. F.I. (Kidneys normal.)	f x u	Operation	Autopsy	......

270	F 23	Child-birth	Rectum, bladder and vagina	u x r	Operation	Improved	......
271	F	Child-birth	Rectum, bladder and vagina	......	....	....	......
272	F 36	Cancer of rectum	Rectum and bladder	......	Colotomy	Autopsy 2 years later	......
273	F 36	Inflammatory	Sigmoid and bladder	f x u	....	Spontaneous cure in 5 months	......
274	M 25	Syphilis	Large intestine and bladder	f x u	Medical	Recovery	......
275	F	Inflammatory	....	f x u	Hydrogen gas diagnosis	....	......
276	M 19	....	Rectum and bladder	......	Colotomy	Autopsy. Death in 3 yrs	......
277	M 28	....	....	rf	....	....	......
278	M 50	....	....	f x u	....	....	......
279	M 61	....	(Kidneys diseased)	f x u	....	....	......
280	M 60	....	Colon and bladder	f x u	....	Autopsy	......
281	M 50	....	....	f x u	....	....	......
282	......	....	Rectum and bladder	......	Colotomy	....	......
283	M adult	....	Sigmoid and bladder	f x u	Irrigation	Great improvement	......
284	F 32	Syphilis and rectal stricture	Rectum and bladder	rf	Medical	Cured	......
285	M	Inflammatory	Rectum and bladder	f x u	Laparotomy and colotomy	Death in 8 days	......
286	F 34	Stone and inflammation	Colon and bladder. F. I.	......	....	Autopsy	......
287	F	Peritonitis	....	......	Vomited urine and fæces	Death	......
288	M	Gunshot wound	....	u x r	Catheter and irrigation	Recovery	......
288	M 24	Gonorrhœa and inflammation	Rectum and bladder. (Kidneys diseased)	......	Sphincter cut and sutured; catheter	Autopsy	......
289	......	Cancer	Intestine and bladder	......	....	....	......
290	M 28	Appendicitis	Rectum and bladder	f x u	Laparotomy	Recovery (?)	......
291	F	Cancer of uterus	Bladder and ileum	......	....	Death	......

TABLE OF CASES—*Continued*

No.	Age and Sex	Cause	Location and number	Urine and Fæces	Treatment	Result	Duration
292	F 28	Inflammatory (?)	....	f x u	....	....	....
293	M 5 mo.	Operation for anal atresia	....	f x u	Operation	Recovery	....
294	F 33	Stricture of rectum	Rectum and bladder	rf	Proposed cystotomy refused	....	....
295	M 35	Cancer of intestine	Sigmoid and bladder	f x u	Laparotomy	Death in 4 days	....
296	M 50	Tuberculosis	Rectum and bladder. F.I	f x u	....	....	....
297	M 36	Cancer of sigmoid	Sigmoid and bladder. (Kidneys diseased)	f x u	Laparotomy	Autopsy	....
298	43	Inflammatory	Colon and bladder	f x u	....	Autopsy	....
299	17	Traumatic	....	u x r	....	Recovery	....
300	7	....	....	f x u	....	....	....
301	....	Inflammatory	....	f x u	Laparotomy, no suture. Simple drain	Recovery	....
302	M 27	Traumatic and gonorrhœa	Rectum and bladder. F. I.	rf	Ext. uret (2); sphincter cut; rectum sutured (3); cath. failed; rectum pulled down and attached to end of sacrum after resection of coccyx	Recovery	....
303	M 36	Traumatic and gonorrhœa	Rectum and bladder	u x r	Perineal dissection, sphincter cut; bladder drained	Recovery	....
304	M 29	Inflammatory	Colon and bladder	f x u	Cystoscope and operation, suprapubic suture of orifice	Improved	....

305	F 43	Rectal stricture	Rectum and bladder	f x u	Colotomy; laparotomy 2 yrs. later	Improved	....
306	F 17	Inflammatory	Appendix and bladder (?)	f x u	Cystoscope; laparotomy	Recovery	....
307	F	Typhoid fever	....	f x u	Medical	Death	....
308	F 62	Diverticula of Meckel	Ileum and bladder	f x u	Laparotomy	Recovery	....
309	M	T. B.	....	......	....	....	....
310	M 43	Cancer (?)	....	f x u	Laparotomy twice	Death	....
311	F 52	Cancer of sigmoid	Sigmoid and bladder	f x u	Laparotomy, resection and erroneous union	Autopsy	....
312	F 33	Postpuerperal inflammation	....	f x u	cystoscoped; orifice found	....	....
313	F 42	Fibroma	....	f x u	Hysterectomy; laparotomy	Great improvement	....
314	F 60	Inflammatory	Sigmoid and bladder	f x u	cystoscoped; laparotomy	Recovery	....
315	F 57	Inflammatory	Rectum and bladder	f x u	cystoscoped; orifice found; suture of orifice; laparotomy	Death	....
316	M 62	Appendicitis	Appendix and bladder. F. I.	f x u	Suprapubic stone removed	Improvement	....
317	M 25	Appendicitis	Appendix and bladder	f x u	Operations: (1) perineal section; (2) colotomy; (3) laparotomy; (4) colotomy closed	Rec. Death in 24 days from obstruction	....
318	F 40	Inflammatory	Ileum and bladder	f x u	Cystoscoped; orifice found; laparotomy	Recovery	....
319	M	Tuberculosis	Rectum and bladder	u x r	....	....	.....
320	....	Inflammatory	Rectum and bladder	......	Irrigation	Cured	....
321	F 30	Actinomycosis	Rectum and bladder. (Kidneys diseased)	f x u	....	Autopsy. Abdom. fistula; great adhesions; numerous fistula	....
322	F 32	Actinomycosis	Rectum and bladder	f x u	Medical	Autopsy	....

TABLE OF CASES—*Continued*

No.	Age and Sex	Cause	Location and number	Urine and Fæces	Treatment	Result	Duration
323	M 35	Actinomycosis	Appendix and bladder. (Right ureter diseased)	......	....	Autopsy	....
324	M 34	Vesical tumor	Large intestine and bladder. (Kidneys diseased)	f x u	....	Autopsy	....
325	F 28	Inflammatory	Sigmoid and bladder. (Kidneys diseased)	f x u	Laparotomy; (2) cystotomy; colotomy	Improvement, then death	....
326	M 67	....	....	rf	Cystoscoped; orifice found	Death 2 years later	....
327	F 42	....	Rectum and bladder	rf	suprapubic; stone removed	No change	....
328	M 41	Cancer of intestine	....	f x u	Cystoscoped; nothing found	Death	....
329	M 61	Inflammatory	Colon and bladder. 3'B. II. (Kidneys healthy)	f x u	Suprapubic	Autopsy	....
330	F 44	Inflammatory	Cæcum and bladder	f x u	Cystoscoped; orifice found. Laparotomy. Bladder sutured; intestine not sutured	Death	....
331	F	Inflammatory	Colon and bladder	......	....	....	....
332	....	....	....	......	Suprapubic; suture	Recovery	....
333	....	....	....	......	Suprapubic; suture	Not cured	....
334	M 60	Cancer of sigmoid(?)	....	f x u	Suprapubic; bladder orifice sutured; 15 days later operation repeated, again failure	Death	....

335	M	Syphilis (?)	Large intestine and bladder	f x u	Suprapubic; orifice not found. 2nd suprapubic failure Laparotomy. Intestine sutured; bladder not sutured	Death	....
336	M 65	Cancer diagnosed(?)	....	f x u	Cystoscoped; nothing found	No change	....
337	M 40	Inflammatory	....	f x u	....	Death	....
338	M 56	Inflammatory	....	f x u	Cystoscopy; orifices found	No improvement	....
339	M 62	Tumor of bladder	....	f x u	Cystoscopy, suprapubic	Death	....
340	M 13	Operation for stone	Rectum and bladder	u x r	(1) 6 ops., failures—*i.e.* perineal approach; (2) Colotomy and suprapubic; (3) Fistula op. 4 times	Cured	....
341	F 33	Abdominal operation	Bladder and colon. F.I.	f x u	Stone removed	Autopsy	....
342	F 40	Abdominal operation	Sigmoid, bladder and skin. 31	f x u	Laparotomy; bladder sutured, intestine resected and sutured. Drainage	Autopsy	....
343	M 49	Inflammatory......	....	f x u	....	Spontaneous recovery of fistulæ	....
344	F 45	Inflammatory (?)	....	f x u	Phosphatic stone found	Result unknown	....
345	F 67	....	....	f x u	Sec. stone found	Result unknown	....
346	F 42	Inflammatory	....	f x u	....	Spontaneous cure	....
347	M 32	Cancer of bladder	Large intestine and bladder. (Kidneys diseased). 21	f x u	Cystoscopy; ulcer found	Autopsy	....
347	F	....	Sigmoid and bladder	.....	....	Autopsy	....

TABLE OF CASES—*Continued*

No.	Age and Sex	Cause	Location and number	Urine and Fæces	Treatment	Result	Duration
348	M 64	Inflammatory	Colon and bladder	f x u	Colotomy	Relieved	....
349	M 49	Inflammatory	Colon and bladder	f x u	Colotomy	Relieved. Death	2 mos.
350	......	Inflammatory	Small intestine and bladder	.....	....	....	....
351	M 50	....	....	f x u	....	8 years in good health; nothing done	....
352	M	Inflammatory	Sigmoid and bladder	f x u	Colotomy	Death	....
353	M	Cancer of rectum		f x u			
354	M 54	Inflammatory	....	f x u	Colotomy	Relieved. Well for 11 years so far	....
355	M 48	Inflammatory	....	f x u	Colotomy	Relieved for 3 years so far. T. B. of testicles 3 years later	....
356	M	Traumatic	Rectum and bladder	rf u x v	Medical; no cath.	Recovery with sinuses	....
357	M	Traumatic	Rectum and bladder	......	Removal of foreign body from bladder	Recovery	....
358	M 53	Traumatic	Rectum and bladder	......	Medical	Spontaneous cure; later, stone removed and recovery	....
359	M 37	Traumatic	Rectum and bladder(?)	u x	Sinuses in groin. Cath.	Recovery	....
360	F 65	Inflammatory	Sigmoid and bladder	f x u	Laparotomy. Adhesions, mass in left iliac fossæ; considered not malignant. Colotomy	Recovered to die 6 months later from pneumonia	2 yrs. and 6 mos.
361	F	Child-birth	Rectum, vagina and bladder	f x u vag.	....	Death by sepsis in 28 days	....

362	M 28	Appendix abscess	Rectum, bladder and cæcum. Purulent cavity orifices. 4	f x u	Medical. (Kidneys not found diseased	Autopsy	3 yrs., 3 mos.
363	M 39	Inflammatory	Rectum and bladder	f x u	Cystoscoped orifice found. Medical, including curettage and cauterization	Improved	....
364	F 60	Cancer	....	f x u	None; cystoscoped; orifice found	Death	....
365	M 45	Inflammatory	....	rf	Cyst.; orifice found. Operation for secondary stone	....	....
366	F 18	Inflammatory (?)	....	rf	Cyst.; orifice found. Gut resected	Death	
367	F	Tubal pregnancy	....	......	Orifice found. Laparotomy	Death	
368	M 54	Inflammation of bowel	Sigmoid and bladder	rf	Cyst.; circular ulcer found. Lap.; fæces in wound. Lap. suture and drainage	Death in 6 days	10 mo.
369	F 45	Swallowed pin 11 years previously. Passed pin by urethra	Sigmoid and bladder. 1	f x u	Laparotomy; nil	Improved	6 mos.
370	M ?	Lithotomy 21 years before	Rectum and bladder	u x r and f x u	Perineal incision. Suture of rectum. Bladder left open	Not stated	Not stated
371	M 28	Calculus (vesical). Size of hen's egg, passed by R. age of 7 years	Sigmoid and bladder. (Kidneys diseased). Surgical. 1	u x r	Abd. oper. (?). Removal of stone (?)	Died	Many years.
372	F 59	Inflammatory	Sigmoid and bladder. 1	f x u	Cystoscoped; laparotomy; Suture both openings	Cured	....

TABLE OF CASES—*Concluded*

No.	Age and Sex	Cause	Location and number	Urine and Fæces	Treatment	Result	Duration
373	M 35	Inflammatory	Sigmoid and bladder	f x u	Bichloride irrigation	Died 1 year later	16 yrs.
374	F 64	Lifting heavy weight	Rectum and bladder. 1	f x u	Diagnosis by cystoscope; Laparotomy; rad. suture	Cured	14 mo.
375	M 44	Inflammatory	Sigmoid and bladder. 1	f x u	Laparotomy; rad.; Suture	Cured 6 months; stone 2½ x 2 inches	?
376	F	Inflammatory	Rectum and bladder. 1	f x u	Application Ag. No. 3 fistulous tract by vagina	Cured	....
377	F 60	Inflammatory	Sigmoid and bladder. 1.	f x u	Colostomy	Improved	13 yrs.
378	M 48	Inflammatory	Sigmoid and bladder. 1	f x u	Colostomy	Improved	13 yrs.
379	....	Inflammatory	Jejunum and bladder. 1	f x u	....	Jewett's	....
380	....	Inflammatory	Rectum and bladder. 1	......	Simple incision of skin-phlegmon	Spontaneous healing	....
381	....	Inflammatory; diverticulum	Sigmoid and bladder. 1	......	Laparotomy; resection and suture	Died	....
382	....	Inflammatory; diverticulum	Rectum and bladder. 1	......	Laparotomy; separation. Suture of both openings	Cure.	....
383	....	Inflammatory; diverticulum	....	......	Laparotomy; separation. Suture of both openings	Cure.	....
384	....	Inflammatory	Cæcum; bladder; abdominal wall	......	Bilateral exclusion	Died.	....
385	....	Inflammatory strangulated herina	Small intestine and bladder	......	Bilateral exclusion	Cured 8 years	....

costal area. On palpation, at times, the lower pole of right kidney can be caught. Skin and glands negative. Reflexes normal; genitalia normal; considerable arteriosclerosis at radials.

Urine: First, cloudy with shreds; second, ditto. Composite examination of 30 specimens. Alkaline, albumin, trace or none, no sugar. Sp. gr. 1012–1017; pus, epith., cocci and bacilli (colon). No. T. B.; rarely blood cells; at intervals a few cylindroids and hyaline casts; *vegetable cells.* Urethra takes No. 26 French sound with ease, hyperæsthesia posteriorly. Prostate—small, soft. Vesicles, right, normal; left, thickened and tender. Mixed secretion, pus and bacilli. Definite thickening of posterior vesical structures.

Patient put on silver nitrate irrigations, urotropin preparatory to further examination.

February 15, 1908: Remarkable change; gain of 18 pounds in weight; urine almost clear; pus reduced; albumin, trace or none; rare hyaline casts; no blood; vegetable cells. Cystoscoped with Nitze cystoscope. Bladder wall healthy except at trigone. The changes are about interureteral muscle which is raised up; very granular and hyperæmic. The ureteral orifices cannot be seen. On right lateral side of the bladder there is an appearance of a crater with puffed reddened lips, projecting into bladder and about this many cyst-like bodies, described by Fenwick as "bunches of grapes." Left side, double œdematous projections with crater-like opening between the lips. In other words, there may be two orifices of fistulæ.

Proctoscopy. Just below last valve and ½ inch to right of median line two small polypoid villi can be seen. A probe introduced between these villi enters into a canal which runs into the bladder. This can be just reached by finger. Bismuth subnitrate and charcoal by mouth can be recovered in urine.

Diagnosis. Rectovesical fistula. A possible slight secondary pyelitis (right); also arteriosclerosis and possible cirrhosis of liver. Based on (1) history, (2) symptoms, (3) cystoscopy, (4) proctoscopy, (5) recovery of bismuth and charcoal in urine.

On account of general condition of patient, *i.e.,* (1) signs of cirrhosis of liver with a possible hepatic infection, arteriosclerosis (2) and lack of discomfort, local treatment was advised; *i.e.* urinary and intestinal antiseptics and bi-daily vesical irrigations. In addition, fistula to be gently curetted and touched with silver nitrate, via rectum, with some improvement, *i.e.* no fæces for nine days, gas only three times in same period. Urine: acid, 1016, slightly cloudy. No sugar, no albumin, slight pus, bacilli (colon), rare hyaline casts.

October 20, 1908: Patient is better than he has been for years. Has had no attacks of fever since May 1, has gained to 158 pounds, and his urine is clear, free from smell, and only rarely does he pass appreciable fæces. Gas is still fairly constant.

May, 1909: Patient is in splendid health, no fæces for three months, and air only twice in the same time. Is on daily intravesical irrigations. Still under treatment.

A table of cases collected from Chavannaz, Cripps, Pascal, Sachs, from the literature and from personal communications, is printed on pages 266–284.

SUMMARY OF RESULTS.

Pascal's cases analyzed	346	
To which are added	39	
Total No. of cases		385
Medical	267	
Spontaneous cure	5	
Surgical	110	
Unknown	3	
Total		385

	Cured	Impr.	Unimpr.	Not known	Deaths	Total
Medical and Spontaneous	48	17	12	63	132	272
Surgical	36	16	4	7	47	110
Unknown				3		3
Total	84	33	16	73	179	385
Operative cases *	32	11	3	4	41	91
Colostomies	9	2		2	20	33
Laparotomies	13	3		1	17	34
Kidneys diseased †						25

	Cases	Orifices found	Nothing found	Not stated	Ulcer
Cystoscopies	13	8	2	2	1

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* Including all operative procedures, cutting of strictures, lithotomies, sphincterotomies (primary and secondary). Deaths are considered operative when dead within three months.

† In 25 autopsies in which condition of kidneys was stated, there was ascending infection 18 times and 15 of these were bilateral.

A STUDY OF ONE HUNDRED AND THIRTY-ONE CONSECUTIVE CASES OF FIBROID TUMORS OF THE UTERUS DEMANDING OPERATION.*

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SEVEN years ago Andrew J. McCosh presented a paper to the American Surgical Association, on the subject of Myomectomy *vs.* Hysterectomy. In reading this excellent paper again, I was surprised to find that it was so sound and up to date. Seven years ago McCosh was, if anything, ahead of his time; but the conclusions which he drew then have borne the test of time. They are as follows:

1. "Myomectomy is possible, advisable, and the operation of choice in young women, even when several tumors demand removal and even if the uterine canal has to be opened, rather than hysterectomy."

2. "In an operation of myomectomy, fear of hemorrhage should be cast aside; bold and rapid methods should be adopted."

3. "The operation is attended by the same danger as hysterectomy."

4. "The ultimate results as regards menstruation, pain, and pregnancy are satisfactory following myomectomy."

When should a fibroid tumor of the uterus be operated upon? When it commences to increase in size or to cause symptoms such as pelvic pain or hemorrhage, either at or between the menstrual periods;—and also occasionally for reflex disturbances such as persistent vomiting, which I have seen on more than one occasion.

Maurice Richardson in answering the question says: "When we postpone an operation on a fibroid tumor we may be causing the patient to run a risk beside which the dangers of an operation are but trivial." Richardson thinks that the same rule should be followed as in ovarian cyst or in appendicitis in the interval; but that a small subperitoneal tumor need not be removed if it is not increasing in size. When upon examination we find a pelvic tumor, if we are careful we can usually make a correct diagnosis as to the character; but not always. And this is especially true in moderate-sized tumors which just fill the pelvis. It is not always possible to be sure that a certain tumor is uterine and not ovarian in origin; the usual error is to diagnose a small ovarian as a fibroid, on account of its smooth, hard, almost solid feel. Within the past month I have made this diagnostic mistake, even after a most careful examination. Again, we cannot be sure that a uterine tumor is innocent and not malignant in character. For this reason any tumor filling the pelvis should, in my opinion, be explored.

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* Read before the American Surgical Association, June 4, 1909.

I have taken for the subject of this paper the last 100 consecutive hysterectomies for fibroid disease, and also the myomectomies, 31 in number, which have been performed during this same period of time.

In deciding between these two operative measures, the question of first importance is the age of the patient; a young woman should always have a myomectomy if possible. A young woman often thinks that she does not want to have a child, but a time is sure to come when she will give anything under the sun for the privilege of seeing her own child. After the child-bearing period the uterus should not be left if by so doing the woman is to run any greater operative risk, or if there is much chance of a return of her disease. I find that 70 per cent. of my hysterectomy patients were forty-five years of age or older. One patient was twenty-five years old; one, twenty-eight; and 28 per cent. were between thirty and forty-five years,—while of the myomectomies 87 per cent. were forty years of age or younger. One of the patients, over forty years of age, had been married late in life and was terribly distressed because she had recently miscarried as a result of an intramural fibroid which choked the pelvis. She gladly accepted the slight additional risk which I then thought would probably follow a myomectomy, and one year later she was successfully delivered. Two years later she had a second child, and I am sure that she is one of the most grateful patients that any surgeon ever had.

After a myomectomy the tumor may reform, or other small growths which were too deeply buried in the uterine wall or were too small to be palpated may increase in size and cause a return of the symptoms and necessitate a second operation. This has occurred three times in my total experience of over sixty myomectomies. Perhaps there have been other cases who have not subsequently consulted me; but of the cases that I have been able to follow—and I believe that I know of the after-histories of most of my patients—the growths have not returned. Of these three cases, two later had hysterectomies, but each was glad that the attempt had been made to save her uterus. In all of these cases the return came inside of two years. After that time the chance of a return is, apparently, very small.

Myomectomy has been done during pregnancy four times with one miscarriage. In each case the symptoms present were threatened miscarriage, one being so acute as to give the attending physician the impression that this young woman was suffering from acute appendicitis with uterine hemorrhage. I would not advise the removal of a uterine tumor in a pregnant uterus which is producing no symptoms. But on the other hand I would not take the ultra-conservative position of some of the best English surgeons who have lately expressed the opinion that myomectomy before the viability of the child is almost never justifiable,—that even after labor has been established obstructing tumors may slide up and slip out of the way. I think a myomectomy just before labor is often the very best way of dealing with obstructing tumors. I remember one—a very large fibroid of the posterior lip of the cervix—completely filling the pelvis and preventing the child's head entering the pelvis at all. This tumor was enucleated from its bed without much difficulty, although there was a profuse flow of blood which could only be stopped by packing the cavity with gauze. The attending obstetrician removed the gauze twenty-four hours later, during labor, while the advancing head compressed the cavity and the woman was successfully delivered of two perfectly healthy, vigorous children. She made a perfect recovery and has been absolutely well ever since.

In regard to the mortality: There have been five deaths in the 131 cases, or 3.8 per cent.; 3 per cent. in the series of 100 hysterectomies, and two deaths in the myomectomies, making 6 per cent. This looks like an unjustifiable mortality for myomectomy, but as both were accidental deaths, and in no way due to the myomectomy, they ought not to be charged to this operation. The first was due to the giving away of the catgut purse-string suture about the stump of an appendix which had just been removed. I have already reported this case in a paper on surgical errors read before the American Medical Association at Atlantic City, two years ago. The second death was probably due to the leaking of a gall-bladder which had been opened and drained through a stab wound, several gall-stones having been found at the time of the operation for a removal of a fibroid tumor.

For several years I have been in the habit of always exploring the upper abdomen with the gloved hand, and if the original operation was not a grave one, I did not usually hesitate to remove, after the manner described by Kelly, slumbering gall-stones when found. Some six months ago, when studying up my own statistics of gall-bladder surgery, I was amazed to find that in 20 consecutive pelvic operations where the gall-bladder had been opened and drained in this way, there had been three deaths, while the general mortality of gall-bladder surgery, leaving these 20 cases out of consideration, was only 2 per cent. Since discovering this fact, I have promised myself that I would not again follow this method, but in the future will always make a secondary opening, which can be properly packed, so that the gall-bladder can be more safely dealt with, or in the majority of cases put off the gall-bladder operation to a later and safer occasion.

Now taking up the three fatal cases following hysterectomy we find that one woman died on the third day, as the result of leaving a tape sponge in her abdomen, and this in spite of all the precautions which are thrown about the use of sponges in the abdomen. A miscount was made by one of the most excellent operating nurses that I have ever had. When we open the abdomen for the purpose of performing any operation we know that it is not without danger. All honest surgeons tell their patients that a laparotomy is not without risk; many are apt to say that there is small danger,—say about 2 per cent. The leaving of a foreign body in the abdomen is and must always be one of the sources of danger; the five and ten-yard packing rolls help very much to lessen the risk, but even then we must have some smaller sponges to mop up the blood, and occasionally one of these may escape our notice. I find that every interne, when cross-examined, knows of at least one such case, although they confess with great reluctance and never tell who the operator was.

The second death may have been a case of slow sepsis, producing peritonitis with obstruction. No autopsy could be secured, but as the patient died from obstructive symptoms on the seventh day I have always felt that it was a volvulus unrecognized until too late. A vaginal section was done on the sixth day and nothing but bloody serum evacuated. Her abdomen should have been opened and explored on this sixth day,—or better on the fifth day, as I look at it now. On general principles I am much opposed to secondary laparotomies on patients seriously ill and apparently dying. My recollections of several such attempts to save life have been that they were all unsuccessful. Usually the one chance in this class of cases is to let them alone, hoping that perhaps we are mistaken, and that they are not nearly as sick as we think.

One case died following a panhysterectomy for a sloughing fibroid of large size which was supposed to be malignant. As the tumor was raised out of the abdomen, I saw a few drops of pus drip from the cervix, which I had already closed with stitches, but which leaked just at the wrong time.

Dr. A. E. Herstler of Kansas City has recently described his bloodless method of hysterotomy in which he uses Moynihan's stomach clamps to control the uterine blood supply and prevent hemorrhage during myomectomy. It seems to me that occasionally this procedure might be decidedly helpful; but judging from my own experience it is not usually necessary. The oozing does not come as a rule from the nutrient arteries of the tumor which Dr. Hertzler ligates, but from the whole raw surface, and from the stitch holes themselves.

One of the principal dangers of myomectomy, as well as hysterectomy, is postoperative hemorrhage. The gradual formation of an hæmatocele, which occasionally follows either operation, should be carefully watched for; because, as Deaver says, "hæmatomata in these cases are dangerous." I have been in the habit of putting in vaginal drainage at the time of the operation, when there was any difficulty in preventing oozing. And twice after myomectomy I have made vaginal section on the third day, opening up and draining such hæmatomata with the most gratifying results. After hysterectomy I have put in vaginal drainage ten times, and on five occasions have later made a vaginal section and put in a rubber tube. Symptoms of collapse, with an increase of pulse rate, will usually give the clue to the condition, and a boggy sensation in the cul-de-sac, especially if the perineum is straddled by one finger in the vagina and one in the rectum, will usually settle the diagnosis.

In my earlier work I lost two cases where the puddle of pus in the cul-de-sac was due to the infected, broken-down blood clot which though it had caused the fatal septic peritonitis was not discovered until the autopsy. To the recognition and drainage of these accumulations of blood more than to any one thing do I ascribe my improved results over a few years ago, when I used to find hæmatomata at the postmortem. If they are recognized and drained early, the patient will promptly recover. If they are not discovered the patient may recover after a long and stormy convalescence; but she probably will not. There is absolutely no shock after a vaginal section, in this particular differing absolutely from the secondary laparotomy, which is nearly always fatal.

On account of these and other experiences with vaginal section in desperately sick pelvic cases, I have made a rule for myself, that I would not let another woman die without making an exploratory vaginal section, for I have seen some truly wonderful recoveries following this procedure,—and the same can be said in regard to rectal section in men with pelvic or general peritonitis.

The danger of a fibroid tumor producing a suppurative pelvic peritonitis is considerable. In the 100 hysterectomies, three cases came to me with pelvic abscesses complicating the tumor, either due to a perforative appendicitis or to the necrosis of the tumor, or to compression of diseased appendages. Eighteen of these 131 cases had old diseased appendages. As the tumor enlarges it squeezes these old inflamed appendages against the sides of the pelvis and causes, occasionally, a slow leak, and this produces a pelvic abscess. When a fibroid tumor is complicated by a pelvic abscess the abscess should first be dealt with by vaginal section and drainage; several weeks should then intervene before attempting to remove the tumor. Many years ago I allowed myself to be over-persuaded by an anxious patient and operated too soon, removing a large fibroid ten days after a vaginal section for pelvic abscess; as a result I lost the woman with a septic peritonitis. Perhaps she would have died anyway, but by my haste I certainly did not give her the best chance to recover.

In regard to the method of performing hysterectomy: Supravaginal amputation has been the operation of choice, and only in malignant or a suspected malignancy have I resorted to complete removal of the uterus, and then for two reasons: First, because it is a less dangerous operation in my hands, and second, because I have never seen a fibroid tumor grow in the stump of the cervix after a supravaginal amputation. Large sized catgut for the vessels, No. 3 or No. 4, is the best ligature material,—or No. 2 double. It is awkward work tying the uterine arteries deep in the pelvis, and much greater force has to be used than would be necessary on the surface,—so the ligature must be larger and stronger. In my judgment, it is always wiser to cut the uterine arteries beside the cervix before picking them up,—for they lie very close to the ureter. The only time that I have ever injured the ureter was in one of my earlier operations, when the uterine artery was ligated en masse before cutting the artery. If the danger of injuring the ureter by a poor surgeon is only one in 200, I do not believe that the uterine bougies are often necessary.

In regard to complications, I have removed the appendix in 71 cases. Inflammatory disease of the appendages has been met and dealt with 18 times. Femoral, inguinal and operative hernia have been met 5 times, goitre once—when the thyroid gland was removed before the uterus on account of the difficulty in breathing. Gall-stones were discovered and successfully removed 8 times; gall-stones were found and not removed 3 times; 7 cases were associated with procidentia, and in these cases the stumps of the round and broad ligaments were sutured to the stump of the cervix (Dudley). Drainage through the vagina was used 10 times at the time of operation. Vaginal drainage was used after the operation 7 times; all but one recovered, as mentioned above.

In regard to the influence of the fibroid tumor on pregnancy: In the 100 hysterectomy cases, 17 of these women had never married. Twenty-two who were married had either miscarried or had never had a pregnancy at all. Seventeen others who were married had not had a child for twenty years; 25 had had their last child between ten and twenty years; 4 had had a child three years and less; the remaining 11 of the 100 cases had last child between five and ten years.

Fibroid tumors were not removed until they had commenced to produce symptoms—pain from pressure on rectum or bladder—and in 32 cases on account of profuse menstruation, many of them bleeding all of the time. The hæmoglobin in one case was as low as 20 just before the operation. This woman made a recovery, but it was much slower than usual. In this latter class the best way is to keep the patient in bed in the hospital under observation and forced feeding, with big hot douches twice a day, postponing the operation until the day when they commence to flow.

RESECTION OF THE SCIATIC NERVE.

NEUROPLASTY: END RESULTS.*

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ALTHOUGH a great deal of work has been done in the field of surgical neurology it is surprising how limited the general knowledge is at the present time concerning the phenomena that attend recovery of function when peripheral nerves have been destroyed or injured. The belief is almost universal that after a divided peripheral nerve has been reunited successfully recovery takes place within a very short time, whereas the process is very slow.

More than a quarter of a century ago Létiévant demonstrated that after division of the median nerve moderate pressure of a blunt object could be felt over the entire area affected. This applies to all peripheral nerves. Létiévant believed that this phenomenon was explained by the intimate anastomosis existing between nerves, the overlapping of sensory areas, and also by vibration communicated to sensitive nerves in neighboring territory. Until Sherrington demonstrated that the motor branches of mixed nerves carried with them afferent sensory fibres whose course he traced through the muscles and tendons of the arm and hand, this apparent paradox was not understood. These afferent fibres are now known to account for the residual sensibility after all the sensory nerves distributed to a part have been divided.

Wonderful additions have since been made to the knowledge of this subject by a remarkable series of studies and experiments made by Head, Rivers, and Sherren. They have not only been successful in giving finality to the problem of deep sensibility, but they have placed us in possession of the knowledge that there are other sets of afferent nerves, which, associated with those mentioned, through their end-organs and fibres, receive and convey stimuli so definitely that their identification becomes easily susceptible of proof. To those who are not familiar with this literature it may be interesting to learn that the experiments which have imparted such *éclat* to the joint labors of this triumvirate were made on the person of Dr. Head himself, who submitted in April, 1903, to an operation in which both the radial and the external cutaneous nerves were divided. In proof of their painstaking methods of investigation, their work on this case extended over a term of years and was published in *Brain* in November, 1908.

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* Read before the American Surgical Association, June 4, 1909.

Their conclusions are that the afferent fibres in the peripheral nerves can be divided into three systems: First, those which subserve deep sensibility and conduct the stimuli produced by pressure. Second, those which subserve protopathic sensibility. This system of fibres and end-organs receives and conveys painful cutaneous stimuli, and the extremes of heat and cold. These fibres regenerate rapidly after successful operation for repair of divided nerve. Third, those which subserve epicritic sensibility, The nerve-fibres and end-organs of this system endow the part with the power to respond to light touch and enable one to discriminate the two points of the compass, and also ordinary temperatures, warm and cool. Epicritic sensibility is very slow in returning.

Contrary to the accepted doctrine that sensation in its recovery spreads from the normal part over the anæsthetic area, they have proved that the reverse is the case and that protopathic sensibility, latent for a time, develops first at the outer confines of the analgesic area, spreading slowly towards its centre; in the meantime the epicritic area of sensibility remains unchanged and its outer lines can readily be defined by the cotton-wool test.

With the spread of protopathic sensibility over the analgesic area the end-organs become extremely sensitive, and at this stage of regeneration pressure causes not only the sense of pressure, but a sensation of bruising and contusion; prick causes intense pain accompanied by tingling, which is very widely diffused, differing entirely from the effect of prick over the normal skin, at the same time localization of the pressure point is uncertain; extreme heat and cold at this time cause painful diffused sensations without the power of discrimination of heat or cold. Even when the process of regeneration and recovery has progressed thus far, the zone of epicritic sense remains absolutely unchanged.

When the diffusion of protopathic sensibility is at last complete, for a long time afterwards the affected area continues to be extremely sensitive to painful stimuli.

It is generally about this time that the epicritic sensibility begins to spread gradually over the affected area; diffusion of both in time is complete and when complete recovery is absolute. The supreme test of complete recovery of sensation is determined by the compass test; the appreciation of the two points two centimetres apart, applied simultaneously to the skin surface.

It is evident that after division of a nerve regeneration and complete recovery of function must solely depend upon conduction restored either by spontaneous healing, primary or secondary suture, or plastic device.

Protopathic sensibility appeared after successful surgical repair of the divided median nerve within an average period of fifty-six days, and was complete within an average period of two hundred and seven days.

Epicritic sensibility, under like conditions, appeared after two hundred and sixty days and was seldom completed within less than a year's time.

It is interesting to note that protopathic sensibility can be restored under conditions in which motor and epicritic recovery are impossible; and this fact is of clinical importance because of its bearing upon the cure of those serious trophic disturbances which, very often, follow the division of nerve-trunks. That complete regeneration can take place in divided peripheral nerves after three years is held doubtful, but within this period many successful cases have been reported.

In the case reported in the present communication a different set of conditions exists, which must be taken into account in gauging the measure of recovery and regeneration accruing from the operative treatment.

The lines (Fig. 5) which have been tattooed on this leg show with fair accuracy the present boundaries of the different areas. The outer line bounds the whole region and the area insensitive to light touch. The line next within marks that part of the whole affected area which is insensitive to pinprick. Between these two lines is the zone of protopathic sensibility, which through its end-organs and fibres receives and transmits painful stimuli and extremes of heat and cold. It is not sensitive, however, to ordinary stimuli originating with ordinary temperatures, warm or cool (see Fig. 6). The darker of the two shaded areas marks the region which responds to the stimuli of deep pressure, which is, however, felt on both sides, shading where it is most readily felt to the next line without, and where it is least felt into the black area. Within this zone there is no response to prick and to temperatures of any degree, hot or cold. The innermost black region marks the area of absolute cutaneous anæsthesia and analgesia —even within this area there seems to be a remnant of response to the stimuli of deep pressure.

A study of the areas of disturbed sensibility in this case brings out the fact that the small sciatic nerve was divided at the time of the enucleation of the great sciatic. The boundaries of this area are also tattooed and show extensive protopathic recovery.

REPORT OF CASE.

GEORGE ELLSWORTH CARLISLE, single, æt. 45, height 5 feet 6 inches, weight 150 pounds. Born in Steubenville, Ohio. Complexion dark, eyes black, hair black. Occupation at intervals nailmaker, hospital steward, dining-car cook. Mother and father were both Americans. Paternal grandfather was an American. Maternal grandmother was French (French Provinces). Had four brothers: one living and well; three dead; two died past age of thirty, cause of death unknown. One died at thirty, cause of death unknown. Had five sisters, two living and in good health. Two sisters died before he was born. One sister was burnt to death. His mother was afflicted with rheumatism. There is no history of consumption or other constitutional disease in his family. No member of his family is known to have had the skin disorder from which he suffers. At birth he was strong and in childhood he had no diseases or injuries. In adult life he had pneumonia, a mild attack, uncomplicated. He has never had syphilis.

The eruption from which he suffers developed at first in 1888, when he was twenty-five years old. Small, round, soft tumors appeared in the centre of his back, ranging in size from a millet seed to a split pea. Upon first discovery there seemed to be a large number of these growths. There were none visible at the time on the neck, face, or front of the trunk. These little tumors grew very slowly, a few of them attaining the size of a small bean. Small growths of the same kind next appeared on the forehead and temples, and in the neck, where they seemed to attain larger dimensions. Most of them were sessile, a few almost pedunculated. At this stage a few developed in the hairy scalp, but not more than three or four. The growth of these tumors has been much more rapid during the last ten years. The small growths are, generally speaking, papular in form; not a few are oval and others are circular. They are soft in texture, many of them have a yielding, velvety touch, and in a few instances the larger ones resemble in touch the soft form of lipoma. He states that on the face and chest many of these lumps would appear and grow as large as a pinhead and then slowly disappear by absorption, leaving a brown stain. A few developed on the anterior surface of the chest. The great majority of them are the size of millet seeds; between twenty and thirty of them have attained dimensions ranging in size from a pea to a good-sized almond (Figs. 1 and 2). Some of the tumors are shaped like a nipple, and others are cone-shaped. Considering their diffusion there is an apparent symmetry in their distribution, although the right hand is free, while the left is moderately involved.

In 1898 one of the tumors about the size of his fist was removed from the right arm above the inner condyle of the humerus. After its removal, the patient says the hand became weak and the little finger and the adjacent side of the ring-finger became numb, and he could not move them, although motion returned to them two or three months afterwards, and within six months the affected hand was quite as available as the other.

At this time, while he can flex the fingers completely, he cannot extend them and there is a well-marked protopathic area, showing that the ulnar nerve was divided and not reunited. One year after the operation the muscles between the thumb and index-finger became atrophied. Practically, the growths extend down the legs to the knees, but not below, and there are none on the feet. The largest growths are, generally speaking, found on the right side of the body. There is much staining of the skin and the staining has developed, he states, since he has had this disease.

In May, 1907, patient noticed a slight swelling on the posterior mid region of the right thigh, which was painful, sensitive, and exceedingly tender to the touch. The pain accompanying the swelling passed away after two months but returned in December after it was accidently struck in climbing through a window to escape from a wrecked car. Immediately after this injury the lump in the centre of the thigh grew rapidly and became very painful. He was obliged to give up his occupation at the end of December, and by the middle of January, 1908, the pain was so severe that he could not stand or walk without great suffering. The slightest pressure over the tumor would cause the most intense local pain, which was transmitted down the leg and diffused over the foot. The pain becoming finally unbearable, he entered St. Vincent's Hospital.

Examination revealed a tumor, as large as a goose-egg, over central part of the right thigh, over the sciatic nerve, pressure on which would almost put the man into convulsions. Locomotion was difficult, and there were scattered areas on the leg of hyperæsthesia and anæsthesia; the latter, although unmeasured, were evidently in excess of the former. There was also a paretic condition of the muscles of the leg and foot on the affected side.

The diagnosis that was made at the time was: Tumor, probably of analogous nature to those on the body, growing on the sheath of the sciatic nerve, which by pressure produced the motor and sensory disturbance complained of.

The first operation was performed on February 4, 1908. A median incision was made over the tumor, extending from its upper to its lower limits. The tumor thereupon presented and proved to be the sciatic nerve with its contents, intimately adherent to the contiguous parts by inflammatory exudation, and adhesions, many recent, others well organized and dense. The incision was extended upwards to the lower border of the gluteus maximus, and below to the centre of the popliteal space. By dissection, blunt and sharp, the sciatic nerve was finally freed and segregated (Fig. 3). The whole nerve now resembled a large, fusiform tumor, every part of the nerve being involved, and extending below well to the point of bifurcation, the external and internal popliteal branches also showing conspicuous enlargement. Examination of the nerve carried with it the impression that the fusiform enlargement of the nerve was a tumor involving the whole nerve, and not, as it proved to be afterwards, a condition in which the nerve invested a large central tumor. This feature was carefully investigated at the time because of the belief that the tumor was a development of molluscum fibrosum in an unusual situation.

The surgical procedure had now to be quickly determined. (1) The rapid growth of the tumor; (2) its infiltrated condition and its tendency to infiltrate the surrounding parts; (3) its great dimensions, involving the entire area of the nerve; (4) the loss of outline of nerve structure and its evident displacement by pressure and infiltration; (5) the loss of muscular power, which was progressive; and (6) the extensive areas of anæsthesia and hyperæsthesia, not to mention (7) the great pain, and the mental and nervous strain, which by this time amounted to anguish—these considerations, and (8) the suggestion of malignant transformation of a benign growth, prompted me to the determination that excision of the nerve was the proper procedure. The upper section of the nerve was made at the lower border of the gluteus maximus between the tuberosity of the ischium and the greater trochanter, and the lower about one inch below the apex of the popliteal space.

During the resection of the nerve every effort was made to preserve any visible branches. The small sciatic nerve was not differentiated at the time of the operation. Hemorrhage was moderate and easily controlled. The anatomic parts were then restored as carefully as possible, the wound closed in layers with iodized catgut, and the skin cut closed throughout with a subcuticular iodized suture. The patient returned to bed in very good condition. The first dressing was made on the tenth day and it was found that union had taken place throughout by first intention.

An inspection of the tumor (Figs. 3 and 4) showed the entire nerve hard, dense, and infiltrated, and palpation failed to reveal the outlines of a central growth. The tumor was fusiform in outline, flattened anteroposteriorly. On all sides, especially anteriorly, its surface showed adhesions, recent and old. The outlines of the nerve-tissue, excepting at the ends, were lost on account of infiltration and inflammatory exudation.

The segment removed was 10¾ inches in length, the diameter at its greatest part was about 3 inches. At both ends, where the tumor tapered from its central enlargement, the surface of the tumor was smooth and regular; but in the middle part the surface was extremely irregular and nodular throughout its circumference, showing that the growth had infiltrated into the whole tissue of the nerve between the bundles of nerve-fibers, and that the tumor was not a localized growth of the sheath of the nerve in which the whole nerve was stretched over the growth intact.

Upon section of the nerve by vertical incision a tumor presented itself, oval in form, its long axis lying parallel with the axis of the nerve, consisting of an exuberant mass, somewhat dense in texture, tough, hard, and fibrous, bleeding readily on the surface on examination, and bulging rather suddenly through the lips of the incision. It measured 2 inches in length and 1½ inches in its longest diameter. The tumor seemed to be encapsulated and intimately adherent to the nerve. On its anterior and posterior surface it approximated the periphery of the nerve, but on its lateral aspects it was densely covered by the nerve, although the effects of pressure could be noted upon the nerve in all directions, causing absorption and attenuation of structure, excepting the inflammatory tissues on the outside of the nerve, which were very dense, irregular, and exuberant.

The chart showing no variations of temperature, the dressings were removed on the tenth day and the wound found to be entirely healed. Examination of the leg showed that there was

FIG. 1.

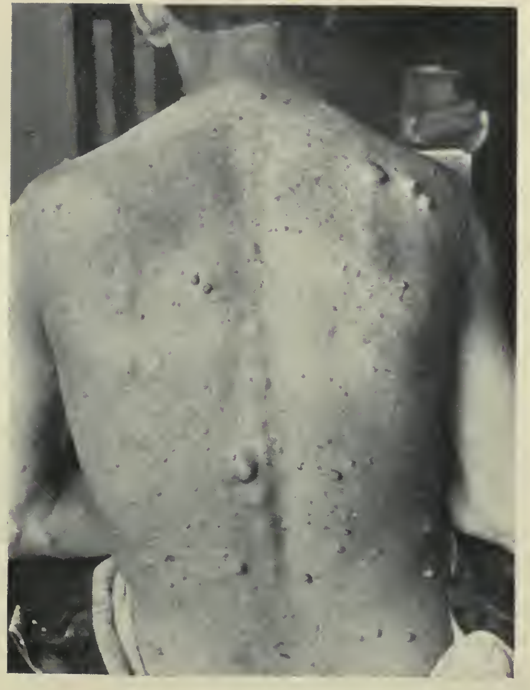
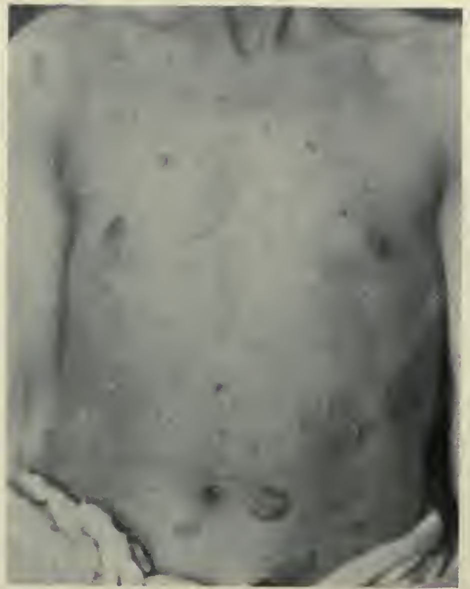
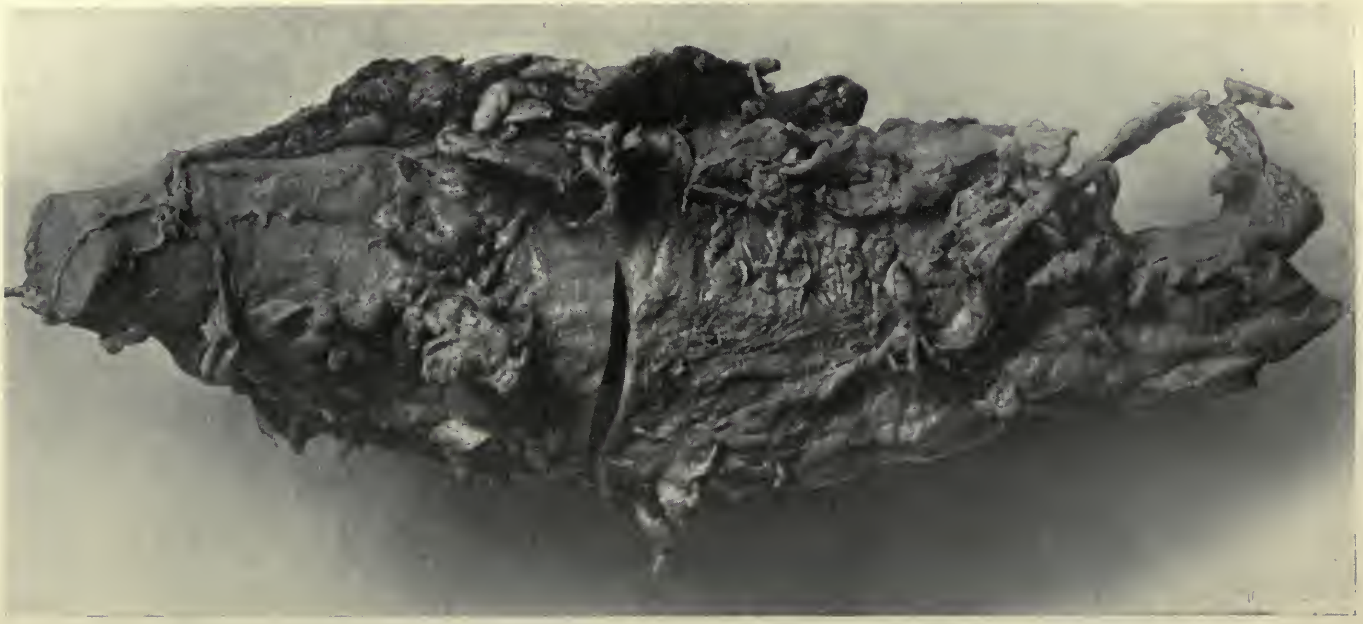


FIG. 2



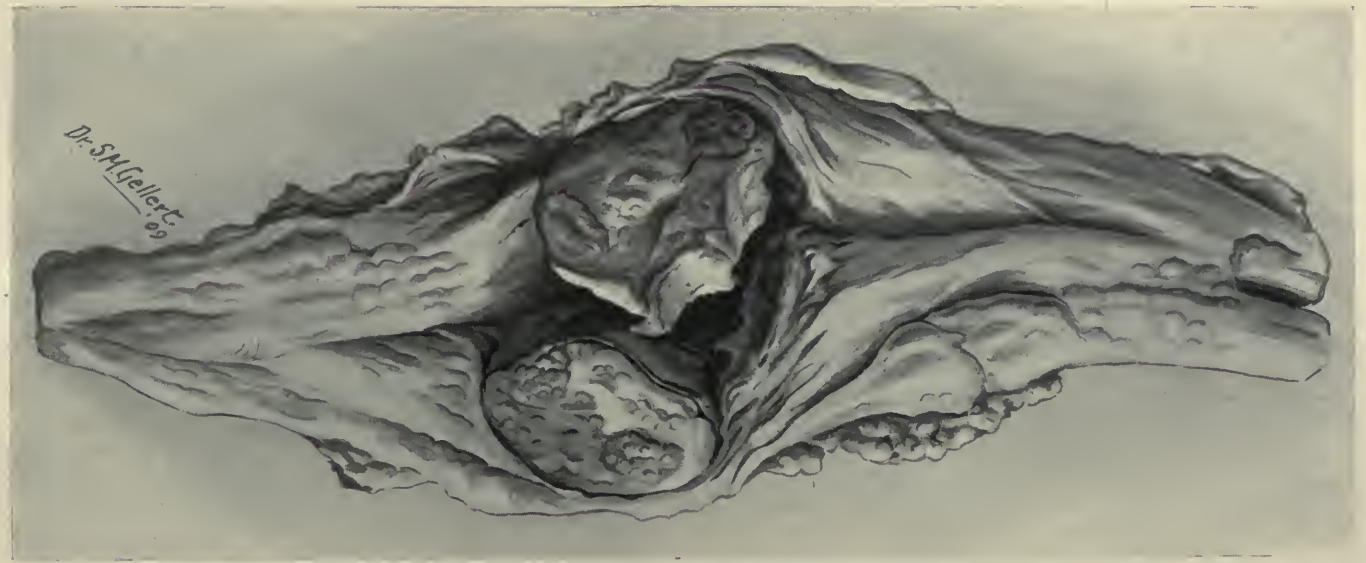
Showing distribution of molluscum fibrosum.

Fig. 3.



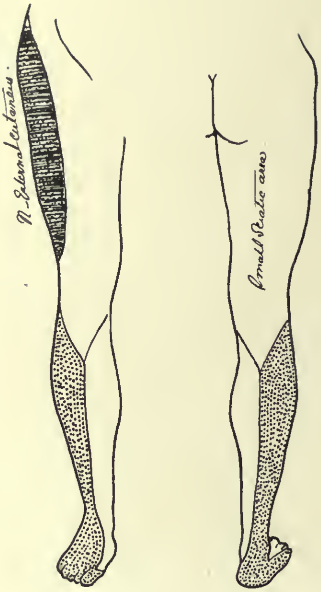
Segment of sciatic nerve removed. Posterior view. About two-thirds natural size. Note loss of nerve tissue by exudation and infiltration.

Fig. 4.



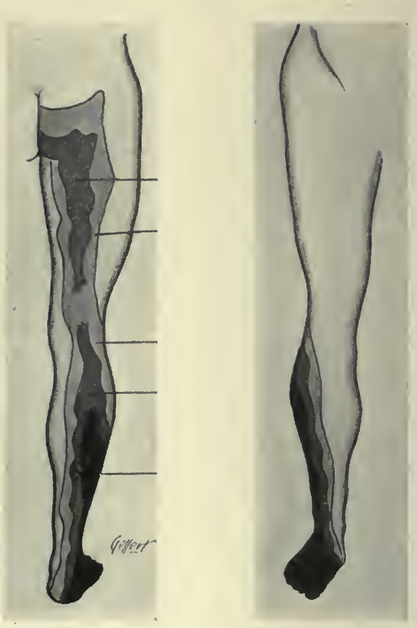
Segment of sciatic nerve. Anterior view, central tumor. About two-thirds natural size. (Drawn from specimen by Dr. S. M. Gellert).

Fig. 5.



The dotted area represents approximately the sensory area supplied by the greater sciatic nerve. The plain white area represents the sensory area supplied by the anterior crural nerve. Note the sensory area independently supplied by the small sciatic nerve and compare it with diagram (6) displaying the areas and degrees of impaired, lost and recovering sensibility in this tract.

Fig. 6.



The outer dark line bounds the whole affected area and displays the entire region insensitive to light touch (cotton wool). The next line within bounds that part of the whole area insensitive to pin-prick. Between these two lines is the zone of protopathic sensibility, which registers painful stimuli and extremes of heat and cold, but not intermediate temperatures. The darker shaded area next within is entirely insensitive to painful stimuli, but responds readily to deep pressure. The black area next within includes the zone of complete anæsthesia,—even in this area there is a remnant of response to deep pressure. Note in comparison with diagram (5) in the area of the small sciatic nerve; 1, the large area of epicritic sensibility (white); 2, the large area of protopathic sensibility (grey); 3, the small area of complete anæsthesia.

absolute paralysis of the leg, and that sensation was abolished except along the inner side of the leg corresponding to the sensory area of the anterior crural nerve. In addition to this the skin of the leg was purplish-red in color and its surface was freely covered with superimposed epithelium and a few medium-sized blebs appeared on the outer aspect of the leg and the dorsum of the foot. The leg was swollen and œdematous.

It is unfortunate that at this stage of the work no minute examinations were made to delimit the area of cutaneous anæsthesia.

Realizing that the leg in its existent condition was little better than no leg at all, it was determined at this time to bridge the gap in the sciatic by making a flap from the internal popliteal nerve in order (Fig. 14), if possible, to establish a path for the conduction of motor and sensory impulses, and at the same time to promote regeneration and to avert the catastrophe of serious trophic change. Accordingly, Carlisle again appeared before the clinic on February 20, 1908, and an incision was made from a point between the tuberosity of the ischium and the greater trochanter, following the line of the original incision in the thigh and extending to a point immediately behind the internal malleolus; the entire length of this incision was two feet six inches.

The central end of the sciatic was found retracted above the level of the lower border of the gluteus maximus. The ends of the popliteal nerves were now recovered, and as part of this operation the end of the external branch was implanted and sutured into the end of the internal branch (lateral).

The internal popliteal nerve, which was still enlarged, was then traced by careful dissection to the inner side of the ankle, and, beginning at the level of the lower border of the internal malleolus, a flap was lifted and split upwards, care being taken at every step to avoid the division of any collateral branch. The division and lifting of this flap was continued upwards to within half an inch of the divided end of the internal popliteal.

The flap was 16¾ inches in length and its diameter a shade less than one-half the diameter of the nerve. It was then laid in the bed of the sciatic nerve and, notwithstanding its length, on account of the retraction of both the divided ends of the sciatic there was little or no slack. Its end was then implanted in a split made in the stump of the sciatic nerve and held by two very slender chromic stitches. This slender filament was about a line and a half in diameter and seemed to contain two or three fibres of the nerve. It was carefully placed over the underlying muscles and imbedded in them throughout its length by a slender iodized catgut suture.

Although the technic of the operation was somewhat elaborate the operation was not prolonged beyond one hour's time. The anatomic parts were then carefully restored in proper relation, sutured in layers, and the entire length of the cutaneous incision closed by a subcuticular iodized catgut suture, a small cigarette drain being left in the popliteal space. The leg was invested in a plaster cast and the leg and thigh adjusted at an angle of 140 degrees. The first dressing was made on the tenth day, and revealed the fact that this long incision, which exposed at least one square foot of surface, had united throughout *per primam.*

Examinations of the leg were now made from day to day, and there was no change noted, but that the leg could be very feebly flexed and it was evident that improvement had taken place in the texture of the skin, which seemed to possess better color, and hereafter the tendency to the formation of blebs and ulcers seemed gradually to pass away.

Believing now that if the transplantation of a few fibres split from the popliteal nerve bridging this large gap in the sciatic nerve would do good by establishing conductivity and promoting regeneration, the addition of a few more fibres might augment the benefits, a third operation was done on April 7, 1908, 67 days after the first operation and 46 days after the second operation. The patient in the interval had been allowed to sit up and move about in a wheel chair, and the limb was handled daily by massage, etc. The third operation consisted in an attempt to split the external division of the sciatic nerve in order to utilize it in the same manner. Incision was made throughout the entire length of the leg as in the previous operations. A careful inspection and dissection of the field of the first operation enabled one to note a definite path of nerve-tissue established in the sciatic gap. The dissection of the external popliteal was much more difficult, but it was finally traced to the same length as the internal and a flap lifted up and placed in the sciatic gap, and tucked in a separate muscular bed to the outer side of the other branch, its ends implanted into a niche previously cut in the stump of

FIG. 14.

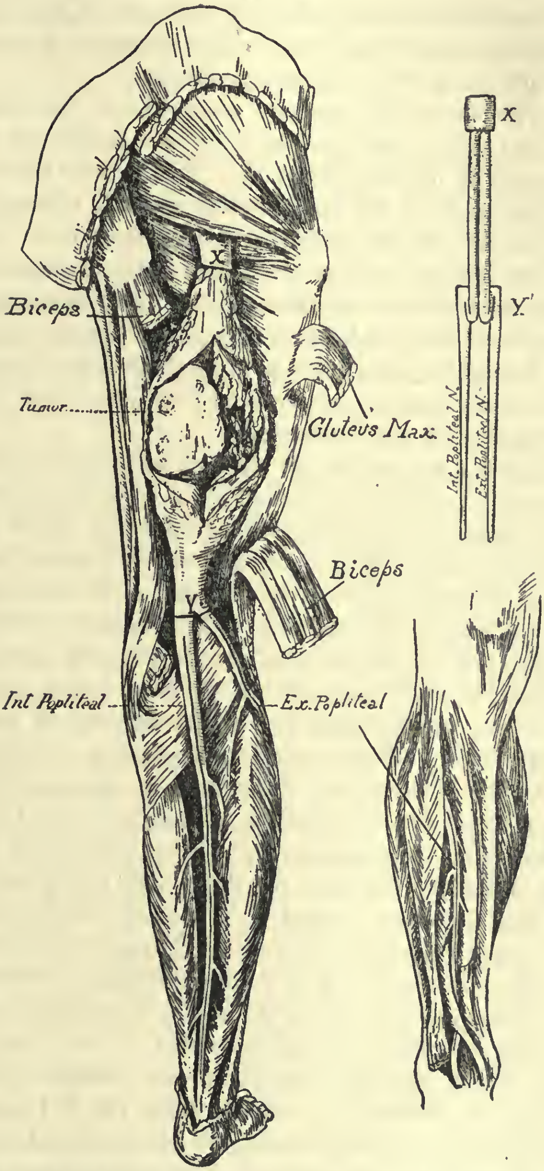


Diagram to show the position of the tumor, the part resected, and the method of division of the internal and external popliteal nerve; also the scheme of suture. (Sketch by Miss S. Hayes).

the sciatic nerve. It was noted in this dissection that only a very moderate amount of scar tissue had formed in the line of the first transplantation. The wound was closed and dressed in the same manner as in the previous operations.

After two weeks the cast was removed for dressing and inspection, and the wound was found to have healed for the third time throughout by first intention. Two weeks later the cast was removed and an adjustable splint applied, which permitted the leg gradually to be extended to a straight line. Hereafter treatment by massage and electrotherapy was instituted and has been continued, more or less, throughout. Examinations showed no change in the areas of sensory disturbance, but it was manifest now that the leg could be bent upon the thigh with more freedom and energy, although it was noticed that there was very little muscular power in the movement.

The external appearance of the leg was at this time flabby and shrunken, the skin harsh and of a purplish color, with a tendency in areas to the collection of epithelial scales in layers. The affected muscles of the leg and thigh became flabby and flaccid, and wasted and failed to respond to the faradic current, and were the seat of the reaction of degeneration. Trophic conditions, however, by this time had improved, and there was now no tendency to the formation of blisters, blebs, and ulcers, although slight traumatisms had led to the loss of one or two nails of the foot. When he was permitted to walk after the removal of the plaster cast, there was no pain or discomfort, other than what was described as a numb, heavy sensation in the leg and foot. Attempts at locomotion showed at this stage an ability to flex the leg upon the thigh moderately, but the condition of foot-drop was absolute. Whenever the leg was flexed it was promptly extended, but the foot dragged in the most helpless way, the position of the foot with reference to the leg being that of a flail. The attitude of the foot is mentioned as showing the loss of every vestige of muscle control.

Electrical observations taken about two months after the last operation showed reaction of degeneration [R. D.] in the hamstrings supplied by the sciatic and also the flexors of the leg and the flexors and extensors of the foot. Observations made four months later, that is, six months after the last operation, showed only partial R. D. of the hamstring muscles and the flexors of the leg, but complete R. D. of the flexors and extensors of the foot. Observations taken in April showed normal electrical recovery of the hamstrings and the flexors of the leg, partial R. D. of the extensors of the foot, and complete R. D. of the flexors of the foot.

ANALYSIS OF THE EFFECT OF THE INJURY.

The excision of the sciatic nerve *in toto* predicates the elimination of all motor and sensory transmission throughout the area supplied by the sciatic nerve and its derivatives. It has not been shown that by anastomosis or the overlapping of territory the anterior crural nerve can contribute much towards the rehabilitation of a district that has been blighted by the removal of the sciatic. Clinical evidence protests the contrary; the sciatic nerve was divided at the level of the gluteus maximus, the first fibres delivered to the hip-joint were probably untouched; the muscular branches distributed to the flexors of the leg, namely, the biceps, semimembranosus, semitendinosus, and the branch to the adductor magnus, were divided. These muscles afterwards wasted and showed a state of flaccid atrophy and paralysis. It is not necessary to say that the entire area of sciatic sensory distribution, that indicated by the diagram, was entirely cut off.

It is more interesting in this study, which involves so intimately the problem of regeneration, to take into account the motor disturbance; and attention is called to the fact that in addition to the hamstring group of muscles already mentioned the muscles supplied by branches of the internal popliteal nerve, namely, the gastrocnemius, plantaris, soleus, and popliteus, were deprived entirely of their nerve-supply, and this group wasted very rapidly and promptly showed the reaction of degeneration; that the flexors of the foot, the tibialis anticus, the extensor longus digitorum, the extensor longus hallucis, and the peroneus tertius were shorn of their nerve-supply and underwent the same paralytic changes; that through the external popliteal branch the extensors of the foot, namely, the tibialis posticus, the flexor longus digitorum, and the flexor longus hallucis, were similarly involved, and likewise the peroneal group and all the groups of smaller muscles of the foot.

I have individualized these muscles and groups of muscles in order to afford a better grasp of the extent to which regeneration has taken place as indicated by motor recovery. It was for a long time held doubtful that regeneration could take place in a nerve in which continuity was lost by division or excision of a segment. It is now known that regeneration will take place over short gaps without previous repair. Hueter has pointed out that it is impossible for regeneration to take place in a nerve over a gap of 1¾ inches or more. Victor Horsley, confirming in general the observations of Heuter, places the limit, from the standpoint of his experience, at 1¼ inches.

It is submitted in this case that a gap of 10¾ inches was made in the sciatic nerve; that, immediately after the removal of the nerve, not only was all sensory and motor transmission eliminated throughout the sciatic area, but in addition all means of conveyance of stimuli by afferent nerves of whatsoever kind; that extensive regeneration has taken place by virtue of an operation in which a gap of 10¾ inches in the sciatic nerve was bridged by two delicate flaps 16¾ inches in length lifted from the two main branches of the sciatic nerve; and that the process of regeneration is progressive are now beyond doubt, and in proof that regeneration has taken place the evidence is listed as follows:

1. Trophic recovery is practically complete. There is now no tendency to the formation of blebs and ulcers and the skin has recovered its natural texture and color.

2. There has been extensive development of protopathic sensibility, much more than could possibly be explained by overlapping from the district of the anterior crural nerve.

3. There has been much recovery of epicritic sensibility, as shown by comparison of the areas of sensory distribution in both legs by diagram.

4. There is almost universal recovery of deep sensation, which is said to be lost when all motor and all sensory nerves to a given part are divided.

5. Recovery has taken place of motion and power in large groups of muscles, which immediately after the excision of

the nerve were reduced to a paralytic state, displaying the usual signs of paralysis and the reaction of degeneration, viz.: (*a*) The flexor group in the thigh: the complete recovery of the semimembranosus, the semitendinosus, and the biceps. (*b*) The flexor group of the leg, the gastrocnemius, the plantaris, the soleus, and popliteus: extensive recovery has taken place in this group and it is progressive. (*c*) The flexors and extensors of the phalanges and foot. Minute examination of these muscles show them now to be firm, strong, and capable of contracting; and while they do not move the foot, they control it, and there is no tendency to foot-drop; some of the muscles of these groups now show only partial reaction of degeneration.

6. The sign afforded by the foot. In the earlier stages of locomotion the foot was helpless and dragged; at the present time it shows muscular control and easy locomotion.

7. The relatively small and contracted area of absolute cutaneous analgesia.

8. The relatively small area of thermic anæsthesia, which is practically coterminous with the area of absolute analgesia.

9. The direct sensibility of the new nerve-tract to deep pressure and the transmission of painful sensibility thereby to the foot.

10. The possession of muscular sense unimpaired.

11. Independent and unaided locomotion.

The following factors may be mentioned which have contributed to the successful results in this case:

(1) Early operation, which the writer believes to be imperative. It might have been better if the neuroplastic work had been done immediately after the removal of the tumor. (2) Implantation in the gap of a large "nerve-element" to establish a nerve-path and foundation for regeneration. (3) The infolding of the nerve-flap in muscular bed so as to prevent the destruction of the delicate nerve fibrils by early formation of scar tissue. (4) The impetus to regeneration of large and dense termini, especially at the central end. (5) The absolute asepsis in three successive operations.

Conclusion.—The lessons to be learned from this case, while not manifold, are important. It tends to show that regeneration takes place from the peripheral as well as from the central end of a divided nerve.

It demonstrates that in given cases peripheral flaps will suffice when central flaps are not available.

Its most obvious lesson, however, rests in the fact which it discloses that by means of plastic operations regeneration on a large scale and recovery of sensation and motion on a corresponding scale can take place after injuries to and operations upon peripheral nerves from which segments have been removed of varying lengths, the limit established by this case being 10¾ inches.

Grateful acknowledgment is made of the valuable services rendered in the various operations and in the preparation of this study by Dr. Frank M. Taylor, Dr. S. M. Gellert, Dr. E. B. Waffle, and the senior members of the class in operative surgery of 1908. Special acknowledgment is made of valuable suggestions made by Dr. R. E. Dolby, of Vancouver, B. C.

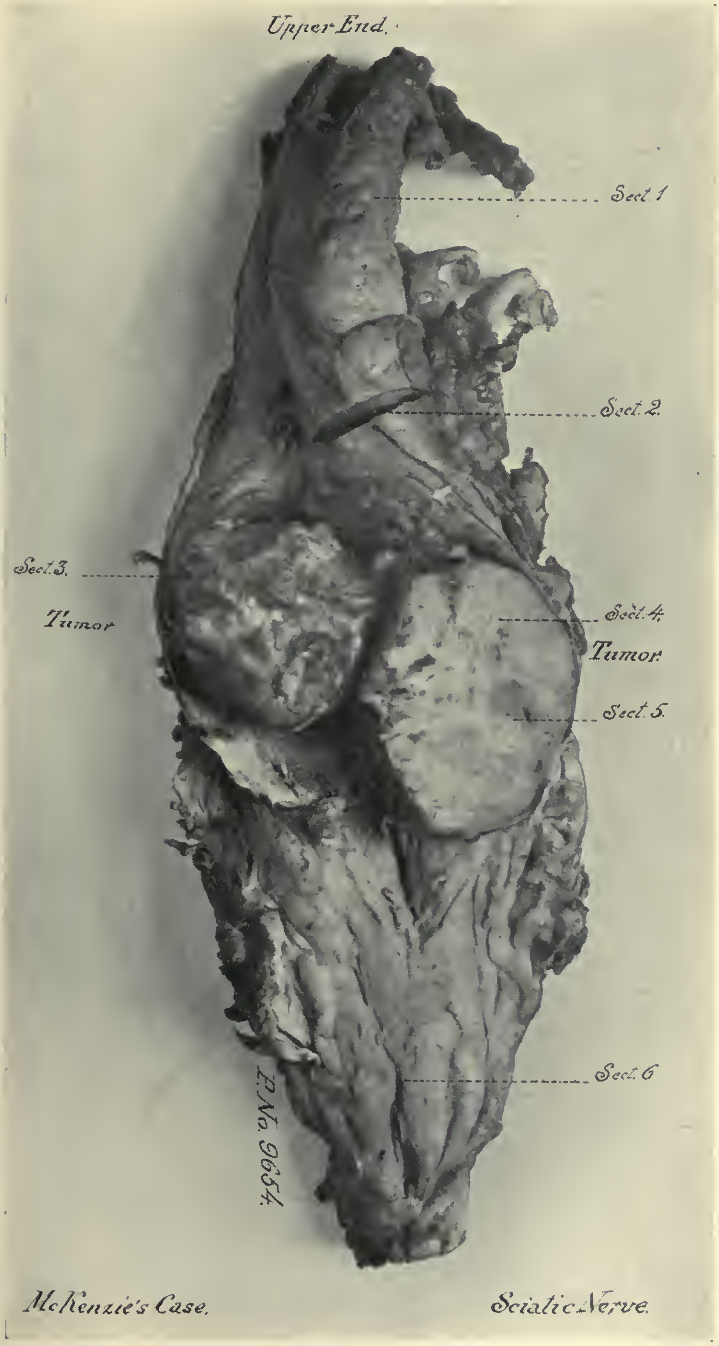
NOTES ON MOLLUSCUM FIBROSUM.

According to Von Recklinghausen this condition develops from the cutaneous nerves and belongs to the neurofibromata. According to Ribbert the cause rests in some disturbance of normal development, as a result of which there is an irregular distribution and arrangement of the connective-tissue elements of the nerves, permitting independent growths. Von Bruns includes molluscum fibrosum, plexiform neuroma, lobulated elephantiasis, pigmented moles, the soft warts, and fibroma of the large nerves under the title of elephantiasis nervorum.

Neurofibromata are relatively common; they grow from the ends of nerves, also from the connective-tissue and perineurium, and are often traversed by nerve-fibres which have been detached by the growths. Tumors of the large nerves grow as a rule very slowly and develop in middle age.

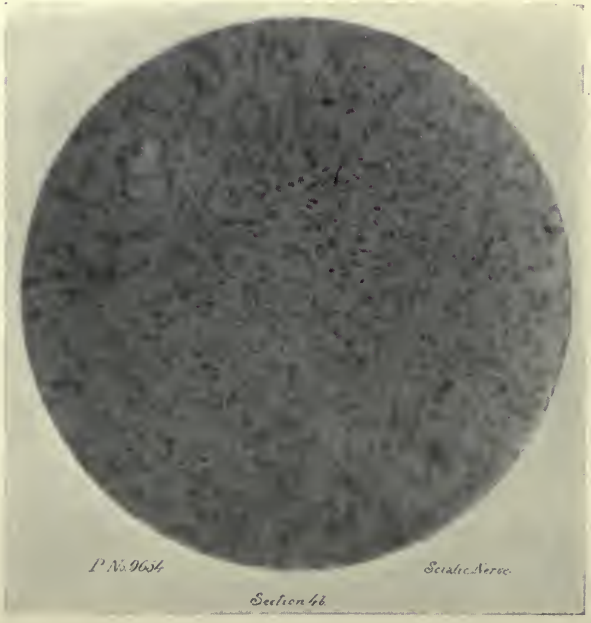
Von Büngner states that sometimes they attack all the nerves, and that in 12 per cent. of general neurofibromatosis fibro- or myxo-sarcoma develops from one or other of the nodules. Garré describes these conditions as secondary

FIG. 7.



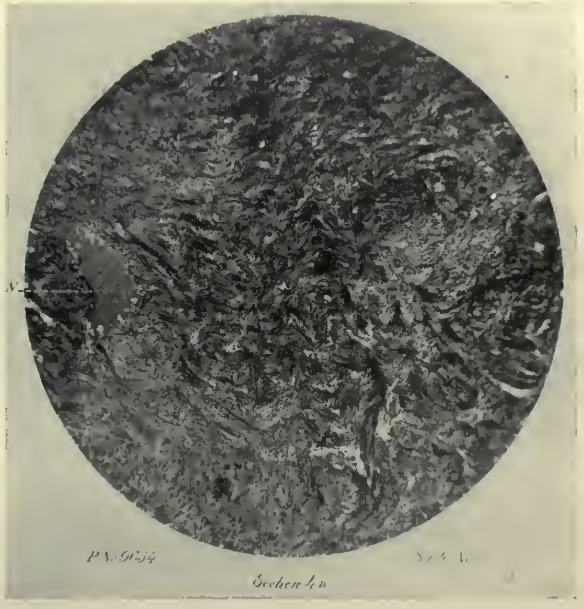
Photograph of specimen removed showing the positions from which the sections were removed for microscopic study. Section 1, upper end of nerve; Section 6, lower end of nerve; Section 3, portion of nerve behind tumor; Section 4, *a* and *b*, tumor; Section 5, similar to Section 4. (See photomicrographs by Mr. H. Schapiro.)

Fig. 8.



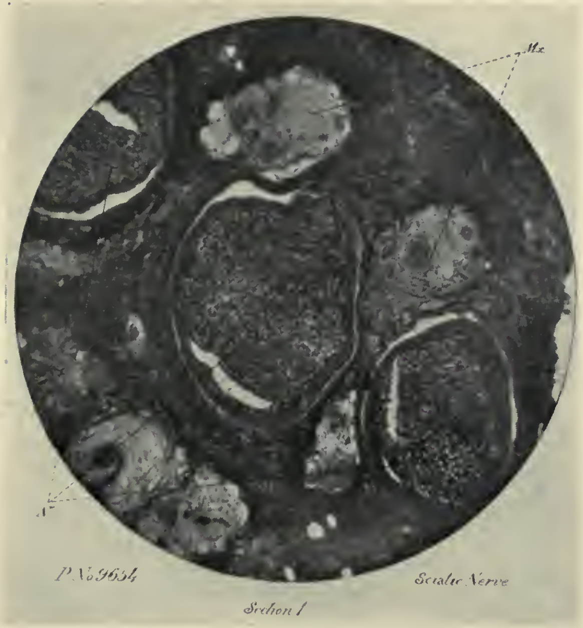
The tumor proper—cellular portion; chiefly spindle cells in a fibrous and myxomatous stroma. (The photomicrographs were made by Mr. Herman Schapiro.)

Fig. 9.



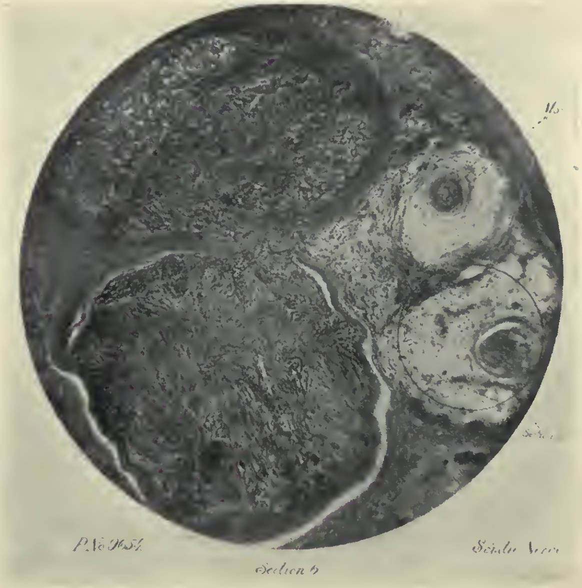
Portion of tumor stained with Mallory and Wright connective-tissue stain. In this area the tumor was much less cellular than in Section 4, *b*. *N*, apparently the remains of a nerve fibre.

Fig. 10.



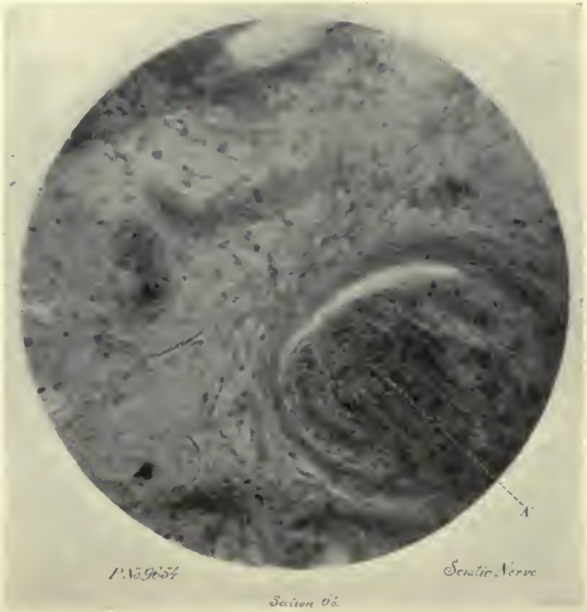
Nerve, upper end. *Mx*, myxomatous residues seen in epineural tissue. The three nerve trunks (*N*) show very little degeneration.

Fig. 11.



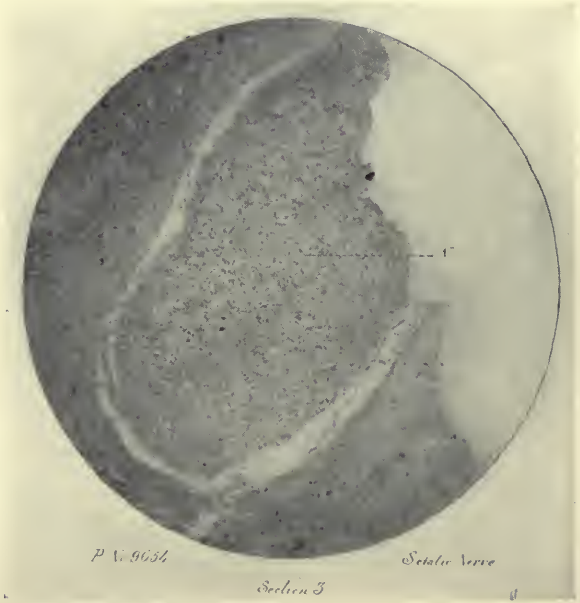
Lower end of nerve. The nerve trunk is larger than in Section 1; there is an increase in endoneural tissue; there is some degeneration of axis cylinders and sheaths. The rudiment shown in Section 1 is also seen here.

FIG. 12



High-power photomicrograph of area marked *Mx* in Section 6, showing myxomatous tissue of the congenital rudiment surrounding a small nerve trunk, *N*.

FIG. 13.



Degeneration of nerve fibre with definite infiltration of tumor cells. Compare this nerve fibre with those shown in Sections 1 and 6 malignant neuroma in contradistinction to primary sarcoma or glioma developing in nerves.

PATHOLOGICAL REPORT.

BY DR. J. C. BLOODGOOD.

The tumor of the sciatic nerve sent by Dr. Mackenzie for examination has been recorded in the surgical pathological laboratory of the Johns Hopkins Medical School and Hospital under the number 9654.

The tumor is malignant—a sarcoma. The sarcoma belongs to that variety which arises from the fixed connective-tissue cells, and in this case it undoubtedly originated in the perineural connective tissue. It is chiefly a spindle-cell sarcoma, but there are areas in which there is a great deal of fibrous tissue. Photomicrograph, Sect. 4b (Fig. 8), pictures the cellular portion of the tumor, and photomicrograph, Sect. 4a (Fig. 9), stained with Mallory and Wright connective-tissue stain, illustrates a portion of the tumor in which fibrous tissue is in excess.

I am not prepared as yet to give a full report on degeneration of the nerve-fibres. In photograph, Sect. 1 (Fig. 10), the nerve above the tumor, as compared with photomicrograph, Sect. 6 (Fig. 11), the nerve below the tumor, one can see that some nerves pass through without degeneration. For this reason I would expect that the patient did not have complete loss of nerve-function; that some of the nerve-bundles were completely degenerated is shown in photomicrograph Sect. 3 (Fig. 13). This was taken from below the gross tumor and shows a nerve-bundle in which it is impossible to make out, except here and there, an axis cylinder and sheath. The perineurial connective tissue still confines the nerve fibre, but the endoneurial connective tissue is practically replaced by tumor cells and degenerated tissue.

The gross appearance of the tumor is shown in the photograph by Mr. Schapiro (Fig. 7). The tumor proper is situated in the sheath of the sciatic nerve; it has pushed the nerve aside and excavated for itself a bed. The tumor is therefore of perineural origin. In the tumor proper I can make out no gross or microscopic evidence of nerve-fibres. This tumor (Sects. 4 and 5) is a fibro-spindle-cell fibrosarcoma, illustrated in photomicrographs, Sects. 4a and 4b. The growth, however, not only produces pressure upon the nerve, but there is direct infiltration into the nerve itself by tumor cells. However, both in the gross and microscopic section, it seems to me that I can trace nerve-bundles through. They apparently lie anterior, if I am correct in assuming that the tumor was posterior. When a section is made through at about the level of Sect. 4 (Fig. 2) the tumor can be seen with a semilunar-shaped nerve-trunk to the anterior side. That some of the nerve-bundles are degenerated is shown from photomicrograph, Sect. 3, taken from the nerve-trunk proper just anterior to the tumor.

Both in Sect. 1 and in Sect. 6, illustrated in the photomicrographs of this number, and in Sect. 2, not illustrated, we see a cellular myxomatous tissue (*Mx*) which probably represents the so-called "Anlage" or rudiment of the tumor. In photomicrograph 6b (Fig. 12) we have a high power of one of these areas.

The lower end of the nerve, Sect. 6, is considerably larger than the upper end (Sect. 1). This is due apparently to hypertrophy of the epineural connective tissue shown in Sect. 6, and an enlargement of the nerve-fibre within the perineurium, and this enlargement seems to be due to increase in the endoneurial connective tissue.

For this tumor resection was undoubtedly the only procedure that promised any hope of a permanent cure. The tumor also belongs to that large group of simple sarcomata in which cures are generally accomplished. The histology of this tumor corresponds with two observations of my own which have remained well, one six years and one three years after operation, but in another case in which the position and histology of the tumor somewhat resembled the position and histology of the tumor in your case, the patient had a free interval, first of seven months after resection, and then a second free interval of four years after amputation for recurrence.

The histological evidence of the "Anlage" (see 6b) of the tumor in the sections taken from the upper and lower end of the nerve, I fear, must be looked upon as evidence suggesting a possible recurrence, but I do not think we know as yet enough about tumors of nerves to be absolutely certain as to this point.

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OBSERVATIONS ON THE INEQUALITIES OF THE RIGHT AND LEFT FEMORA.*

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THE opening sentences of the second chapter of Darwin's "Descent of Man" are as follows:

"It is manifest that man is now subject to much variability. No two individuals of the same race are quite alike. We may compare millions of faces and each will be distinct. There is an equally great amount of diversity in the proportions and dimensions of the various parts of the body, the length of the legs being one of the most variable points."

The late Dr. Jarvis S. Wight, in two valuable papers written in 1877 and 1878, called attention to the inequalities of the lower limbs, which occur normally,—that is to say, in case where no fracture has ever occurred,—and he pointed out the importance of recognizing this fact in the treatment of fractures, not only from a practical but also from a medicolegal standpoint. The first paper of Dr. Wight was published in the *Archives of Clinical Surgery,* vol. i, No. 8, February, 1877, and the second paper appeared in the "Proceedings of the Medical Society of the County of Kings," January 21, 1878.

In the first paper, which was in effect a report of a clinical lecture, Dr. Wight, after rehearsing the fact that experts differ in their measurements of limbs, and that one expert will sometimes have various differences after several comparative measures of the two limbs, states that it occurred to him to make a number of measurements of the lower limbs of those who have never had the femur broken. These measurements were all made from the anterior superior spine of the ilium to the lower extremity of the internal malleolus, with the figures of the tape line down, so as to be invisible. Dr. Wight thus measured 60 individuals; in only ten out of the 60 cases were the lengths of the two lower extremities equal. We may tabulate his results as follows:

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* Read before the American Surgical Association, June 5, 1909.

Cases	Variation of limbs
10	no
4	⅛ inch
25	¼ inch
13	½ inch
4	⅜ inch
1	⅝ inch
1	⅞ inch
1	1 inch
1	1⅜ inch

In considering the importance of these differences we may certainly exclude the four cases in which the difference was but ⅛ of an inch and the 25 cases in which the difference was but ¼ of an inch as of no practical importance. Not so, however, with the remaining 21 cases, being more than 34 per cent. of the whole number measured. In these 21 cases in which the variation exceeded ¼ inch, there were 4 of ⅜ inch; 13 of ½ inch, and one each respectively of ⅝ and ⅞ inch, one inch and one inch and three-eighths variation, and this in individuals who had never been the subject of fracture.

Dr. Wight very justly observes, in view of these figures, that to assume in cases of fractured femur that the two femora were usually of the same length, might involve an error of more or less gravity. In fact in the series in question, taken at random, 10 only out of 60 cases had lower extremities of equal length. Dr. Wight also quotes an article by Dr. W. C. Cox, *Am. Jour. Med. Sciences,* April, 1875, where the reporter states that after accurately measuring the normal lower limbs of 54 individuals there were 15 cases which showed a difference of ½ inch or more, the greatest difference being ⅞ inch.

In November of 1877 Dr. F. H. Hamilton (*Hospital Gazette and Archives of Clinical Surgery*) ridiculed the claims of

Dr. Wight concerning the frequency of inequality in the lower limbs, and January 21, 1890, at a meeting of the Medical Society of the County of Kings, Dr. Wight replied to him by citing the results of 42 measurements in a new series of cases. In this series there were 13 cases in which the normal lower limbs were of equal length and 29 cases in which inequalities existed. Tabulated as follows:

Difference	Number of cases
⅛	1
¼	14
⅜	5
½	4
⅝	3

Combining the two tables of Dr. Wight the left lower limb was the longest in 52 cases, the right in 27 cases. In 26 cases there was a difference of half an inch or more and in 9 cases the difference was over half an inch. The brief controversy between Dr. Wight and Dr. Hamilton was ended by a letter from the latter to the former, in which he states that after a dozen measurements made with great care by himself and his house surgeon, a large majority were of unequal length, the left being generally the longest, and he acknowledged the correctness of Dr. Wight's position.

It is somewhat strange that this matter of the inequality of the lower limbs with its bearing on the question of fractures of the femur has received so little attention in the text-books. In " Gray's Anatomy " a brief footnote simply refers to the claims of Dr. Wight. The matter seemed of sufficient importance to the writer, however, to merit further investigation, and as Dr. Wight's papers had no dissecting-room data, it seemed wise to have actual measurements of disarticulated bones in order to determine beyond the possibility of a doubt whether Dr. Wight's claims could be substantiated. The actual bone measurements were chosen because it is evident that whatever divergence might exist between different observers when measuring from the anterior superior spine to the lowest point of internal malleolus, no such divergence was possible in laboratory measurements of companion bones. The humeri were also examined and compared in order to determine the truth of Dr. Wight's claims that when the femora were unequal the humeri were also unequal, the inequality being hemilateral. It is evident, of course, that in cases of fracture of the femur, if this be a fact, that the measurement of the humeri in the same individual would indicate whether the femora were originally equal, and if not, which side was originally the longest.

The writer desires to submit tables of measurements of 124 cases, in all of which measurements of paired humeri and paired femora were made. One series of cases of 54 were measured in the anatomical laboratory at Columbia University. Another series of cases, 50 in number, were measured in the anatomical laboratory at the University and Bellevue Medical School, and a small series of 20 cases from other sources were made by my assistants, Drs. E. H. Fiske and R. M. Rome. I wish to acknowledge the great courtesy offered me at the anatomical laboratory at Columbia University and also the University and Bellevue Medical School. I am indebted to Dr. Fred. Tilney, associate in anatomy, for the measurements made at Columbia, and to Dr. W. C. Cramp for the measurements made in the University and Bellevue Medical School. The work was laborious and time consuming, and I deeply appreciate the invaluable assistance of the gentlemen who so kindly rendered it possible for me to write this paper.

I submit first the tabulation of measurements made by the Department of Anatomy, Columbia University. The measurements are in centimetres. The entire bone was measured at Columbia with an apparatus similar to the familiar shoemaker's rule with sliding arm. At Bellevue the measurements were taken from the tip of the great trochanter of the femur to the external condyle. The Columbia measurements were made on 54 subjects. The University and Bellevue on 50 cases.

The Long Island cases were 24 in number, making a total of 128 subjects, a total of 512 measurements.

TABLE I.—Columbia University, Department of Anatomy.

No. of Subject	Humerus		Femur		No. of Subject	Humerus		Femur	
	R	*L*	*R*	*L*		*R*	*L*	*R*	*L*
1805	31.6	31.4	43.	43	2096	34.1	33.8	45.4	46.1
1812	31.2	31.6	42	42.4	2001	34.4	33.8	45.4	45.1
1778	33.4	34.	48	47.8	2042	31.2	31.4	43.6	43.6
1752	34.8	34.6	47.8	47.4	2023	33.2	33.4	47.8	47.6
1762	31.8	31.4	43	42.4	2061	34.4	34.2	46.1	45.8
1768	32.2	32.2	45.8	46	2005	34.1	33.6	44.8	45
1790	33	32.2	45.8	46	2085	32	32	45.1	44.8
1798	33.8	33.4	48.6	48.4	2013	35.	35.1	47.4	48.1
1774	32.6	32.2	44.8	44.4	2044	33	32.4	44.2	44.6
1757	32.8	32.1	46.4	46.	2088	32.8	32.9	43.	43.
1785	34.	34.	46.8	47.4	2098	35.	34.8	51.8	51.6
1766	31.4	31.4	45.4	45.4	7A	32.4	32.4	45.4	46.4
1755	34.1	34.	48.	47.1	2008	29.6	29.1	42.	41.8
1694	32.	32.4	46	46.	1759	33.	32.8	44.	43.8
1816	32.4	32.	45.	45.2	2089	31.8	30.8	44.	44.
1782	31.2	31.1	44.2	44.2	2068	34.1	33.8	47.1	47.2
1784	32.4	32.8	45.4	45.6	2079	34.6	33.	43.2	43.2
1815	34.	34.1	48.8	49.1	18A	34.	33.1	47.6	47.2
1799	31.8	31.8	43.6	44.	2060	32.8	32.	46.6	45.9
1743	32.2	32.2	43.2	43.	2070	31.1	31.4	42.6	42.8
1760	31.8	32.6	42.2	43.	2075	33.8	33.	48.6	48.
1818	31.2	31.	43.4	43.4	2086	27.4	27.2	38.	38.
1767	31.4	31.2	43.	43.	124	34.5	34.8	46.	46.
57	32.2	32.	43.	43.	102	33.4	32.9	47.	46.5
55	32.	32.4	44.4	45.2	54	31.4	31.2	43.	43.4
50	32.9	32.2	45.	44.	118	30.8	31.	43.	43.2
64	33.4	32.2	46.1	46.6	105	32.4	31.5	43.8	44.4

Review and analysis of Table I bring out the following facts:

First, that the length of the human femur and humerus varies in such a way as to make possible a division into four classes upon this basis, as follows:

Class I.—Femurs equal, humeri equal in same subject. Frequency, 1.8 per cent. Reference, Case No. 1766.

Class II.—Femurs equal, humeri unequal. Frequency, 22.2 per cent. References, Cases No. 1805, 1694, 1782, 1818, 1765, 57, 2042, 2088, 2069, 2079, 2086, 124.

Class III.—Femurs unequal, humeri equal. Frequency, 11.1 per cent. References, Cases No. 1768, 1785, 1799, 1743, 2085, 7a.

Class IV.—Femurs unequal, humeri unequal. In this class two types to be distinguished, *i.e.,* Type A: Greater length of homolateral humerus and femur; Type B: Greater length of contralateral humerus and femur. Frequency, 64.8 per cent. References: Type A, Cases Nos. 1812, 1752, 1762, 1790, 1798, 1774, 1757, 1755, 1816, 1784, 1815, 1760, 55, 50, 64, 2001, 2061, 2005, 2013, 2098, 2008, 1759, 18a, 2060, 2070, 2075, 102, 118. Type B, Cases Nos. 1778, 2090, 2023, 2044, 2068, 54, 105.

Second, that in the subjects presenting inequality of the humeri, the greater length was observed on the right side in 34 cases as against 11 on the left side, while the cases which showed inequality in the femurs were 19 on the right side having the greater length as against 18 on the left side.

Third, that in cases in which the right humerus was longer than the left, the maximum difference between the two sides was 12 mm., whereas in those cases in which the left humerus was longer than the right the maximum difference observed was 4 mm.

TABLE II.—University and Bellevue Medical School, Department of Anatomy.

No. of Subject	Humerus		Femur		No. of Subject	Humerus		Femur	
	R	*L*	*R*	*L*		*R*	*L*	*R*	*L*
1	31.	31.	38.5	39.	26	36.75	36.5	52.5	53.
2	31.5	31.5	39.	39.25	27	33	33	44	44.25
3	34.	34	44.25	44.5	28	32.5	32.5	43	42.75
4	32.5	32.5	45	45	29	37	37.25	45	45.5
5	35.5	35.5	48.5	48.5	30	33	33	44.5	44.5
6	29.5	29.75	38.5	38.75	31	32	32	45	45
7	29.5	29.5	40.5	40.5	32	31.5	31	41.5	41.5
8	31	31	41	41	33	29.5	29.5	38.5	38.5
9	28.25	27.75	41	40.5	34	32	32	44	44
10	32.5	32.5	40	40.25	35	32	32.5	46	46.5
11	31.5	31.5	40.5	40.75	36	31.5	31.25	42.5	42
12	30.25	30.5	42	42.	37	33.5	33.5	45.3	45.5
13	34.5	34.5	41	41	38	30.75	30.5	42.5	42.5
14	32	32.5	42	42.25	39	36	36.25	46.25	46
15	32	32	42.5	42	40	32.25	32	43	42.5
16	31.75	32	43.5	43	41	31.5	31.25	44.25	44
17	31.5	31	41	41	42	33.	33.	45	45.5
18	29.5	29.5	46.25	46.25	43	33.5	33.5	44.75	44.75
19	32.5	32.25	43.5	43.5	44	31.	31.	44.25	44
20	34.5	34.25	44.25	44.5	45	31.5	32	43.5	43.75
21	30.5	30.5	40.5	40	46	34	33.5	45	45.5
22	32.	32.	43.5	44	47	31.5	31.5	44	44.25
23	34	34	46	46.25	48	38	37.5	40	39.5
24	31.5	31.5	41.5	41.5	49	32.5	32.5	45.5	46.5
25	28.25	28.5	41.25	42.25	50	33.75	33.5	48	47.75

Fourth, that in cases in which the right femur was longer than the left, the maximum difference observed was 9 mm.; while in cases in which the left was longer than the right the maximum difference was 10 mm.

Fifth, that the mean excess in length of the right humerus over the left was 4.9 mm. and that of the left over the right was 2.6 mm.; while the mean excess in length of the right femur over the left was 4.2 mm. and that of the left over the right was 4.7 mm.

The tabulated series of 50 cases obtained from the Anatomical laboratory of University and Bellevue is given in Table II.

Class I.—Femurs equal, humeri equal in same subject in Nos. 4, 5, 7, 8, 13, 18, 19, 24, 25, 30, 31, 33, 34, 43, fourteen cases in all. Frequency 28 per cent.

Class II.—Femurs equal, humeri unequal, Nos. 12, 17, 19, 25, 32, 38, six cases. Frequency 12 per cent.

Class III.—Femurs unequal, humeri equal, Nos. 1, 2, 3, 10, 11, 15, 21, 22, 23, 27, 28, 37, 44, 47, 49, 42, sixteen cases. Frequency 32 per cent.

Class IV.—Femurs unequal, humeri unequal. Type A: Greater length of homolateral humerus and femur. Cases 6, 16, 29, 35, 36, 40, 41, 45, 48, nine cases. Frequency 18 per cent. Type B: Contralateral cases, Nos. 9, 20, 26, 39, 46, five cases. Frequency 10 per cent. Total 28 per cent.

Unequal humeri: Right longest in 13 cases; left longest in 8 cases.

Unequal femora: Right longest in 12 cases; left longest in 20 cases.

Mean difference, humeri, 3.3 mm.; mean difference, femora, 3.8 mm. Maximum difference, humeri, 5 mm.; maximum difference, femora, 1 cm.

TABLE III.—Long Island Hospital.

No. of Subject	Humerus		Femur		No. of Subject	Humerus		Femur	
	R	*L*	*R*	*L*		*R*	*L*	*R*	*L*
1	31·5	31	45·5	45	13	37	37	43·5	43
2	34	34	46	46	14	33	33	43	43
3	27	27	38	38	15	33	34	43	43
4	33	33	49	49	16	31	30.5	42	42.5
5	33·5	34	43·5	44	17	31	31	40	40.25
6	35	34·5	45	44·5	18	24	23·75	42.5	42
7	34·5	34·5	45·5	45·5	19	34	34	45	45·25
8	30·5	30·5	41	41	20	35·25	35	42	41·75
9	30	30·5	39·5	39	21	31.5	31.5	43	43
10	30	30	42	41	22	29	29·75	39	40.5
11	32	31	44·5	45·5	23	30	30	43	43
12	32	32	42	43	24	27·75	27	37·25	36.5

The Long Island cases were measured in a manner similar to that employed at Columbia, a rule with sliding arm being used. The series may be analyzed as follows:

Class I.—Femurs equal, humeri equal, Nos. 3, 9, 15, 2, 4, 8, 16, 22; eight cases. Frequency 33 per cent.

Class II.—Femurs equal, humeri unequal; one case, No. 15. Frequency 4 per cent.

Class III.—Femurs unequal, humeri equal, Nos. 11, 13, 23, 14, 18, 20; five cases. Frequency 22 per cent.

Class IV.—Femurs unequal, humeri, unequal. Type A: Greater length of homolateral humerus and femur, seven cases. Reference, 1, 5, 6, 7, 19, 21, 23, 25. Type B: Greater length of contralateral humerus and femur, three cases. Reference, 10, 12, 17.

Inequality of Humeri.—The right was longest in 8 cases, and the left was longest in 4 cases.

Inequality of Femurs.—The right was longest in 8 cases and the left longest in 6 cases.

When the right humerus was longest the mean difference was 1 centimetre, and when the left humerus was longest the maximum difference was 1 centimetre. The left humerus the same. The right humerus being longest, the mean difference was 5.9 mm., and 7.5 mm. when the left was in excess. The mean difference when the right femur was the longest was 5.6 mm., and when the left was in excess 7 mm. Maximum humerus, 1 cm.; maximum femur, 1 cm.

A summary of the three series is as follows in percentages: Femurs equal, humeri equal, Columbia, 1.8 per cent.; Bellevue, 28 per cent.; Long Island, 33 per cent. It thus appears that the highest percentage in which we could expect symmetry of the extremities is 33 per cent.

In Class II, in which the humeri were unequal but the femurs equal, the Columbia percentage was 22.2 per cent., Bellevue 12 per cent., and Long Island 4 per cent.; therefore in about 20 per cent. of the cases unequal humeri would be accompanied by equal femurs, and Dr. Wight's rule would therefore not apply.

In Class III, where the femurs were unequal and the humeri were equal, the percentages were as follows: Columbia

11.1 per cent., Bellevue 32 per cent., Long Island 22 per cent.; that is to say, although the femurs were unequal, the humeri would be equal in about 22 per cent. of these cases, so that again Dr. Wight's rule of comparison of humerus with companion femur would be fallacious. Taking the two classes together, Class II and Class III, and the rule would not apply in at least 40 per cent. of the cases.

In Class IV, in which both upper and lower extremities were unequal, the percentages were: Columbia 64.8 per cent., Bellevue 28 per cent., Long Island 44 per cent., giving an average of 45.6 per cent., in which both upper and lower limbs were asymmetrical.

In the whole series of cases the right humerus was longest in 55 cases, and the left in 23 cases. This preponderance of length of the right over the left humerus may readily be accounted for by righthandedness. Correspondingly, the right femur was longest in 39 cases, the left femur in 44 cases. This does not entirely agree with Dr. Wight's conclusions that the left femur is the longest where inequalities exist in so large a proportion of cases as his measurements on the living subject indicates; still in this series of carefully measured cases, the left femur is longer than the right in 44 out of 83 cases. The companion tibiæ were unfortunately not measured; but from a comparison of these figures it is quite probable that where one femur was longer than another the corresponding tibia was also longer,—and if we assume that the maximum and mean differences of the tibiæ were proportionate to the femoral differences, the total inequality of the lower limbs would be nearly double the inequalities of the femora alone. The average maximum difference of the three series where the humeri were longer was 7.2 mm., about three-quarters of a centimetre, and the mean difference, 6.5 mm. Where the femurs were unequal, the average maximum difference was 9.8 mm., and the average difference 8.6 mm.

One hundred and twenty-eight cases were measured in the entire series, and in 99 of these cases the femora were unequal.

It therefore appears that symmetry of the femora in the same individual is exceptional and that asymmetry is the rule. At least in 78 per cent. of the cases recorded, asymmetry existed, and in cases of asymmetry the average disproportion in length of the femur alone as measured on actual specimens of bones was very nearly 1 cm., and if we add a variation in the companion tibiæ of but ½ cm., the total variation on the ordinary surgical measurements would be not far from 1½ cm. It may readily be seen, therefore, that if the short bone were fractured the apparent shortening would be very much greater than the actual shortening, and if sufficient weights were put on the injured limb to make the femora equal, something that they were not originally, the ends of the bones might be actually separated by a distance which might lead to non-union. The best method of preventing such an untoward circumstance at present seems to be in the routine employment of the Röntgen photograph, for there seem to be so many sources of error possible in using sound bones in the same individual as a means of comparison, that no fair deduction could be drawn therefrom. The present methods of measuring the lower extremities are unsatisfactory in the extreme. The anterior superior spine, except in very lean individuals, is a very uncertain quantity, and no two men are likely to agree on what is the lowest point of the internal malleolus. The umbilicus has been discredited as a point from which to measure, but it has occurred to the author that possibly the sternal notch might be available, the lower point of measurement being the plane of the heel in line with the internal malleolus, this plane being determined by the apposition of any plane surface to the foot. The upper end of the tape is fixed at the sternal notch and not moved for the measurement of either side, the lower end of the tape being swung first to the plane of the right heel and then to the plane of the left. In order to determine which of the three methods was least open to individual error, my assistants, Drs. E. B. Fiske and Russell W. Rome, made a series of 312 measurements of paired femora in 52 male subjects, neither being aware of the figures obtained by the other.

These measurements were most carefully made with the following results: (1) The average variation between the measurements made by the two men, anterior superior spine to malleolus, was 1.07 cm. (2) In measuring from the umbilicus to a plane surface in apposition with the plane of the heel the average variation was 1.24 cm. (3) In measuring from sternal notch to plane of heel, the average variation was 1.10 cm. (4) The smallest variation was from sternal notch to right femora, being a mean of 1.04 cm. The greatest variation was on the left side, umbilical measurement, 1.27 cm. (5) In 312 measurements there was exact agreement in only 40 cases, a little over 12 per cent. of all cases measured.

It is my impression that the measurement taken from the sternal notch to the plane of the heel, as indicated by a plane surface in apposition therewith, will prove to be a method least open to error. The following precaution, however, must be adopted. The measurements must be made at the same period of respiration. The plane surface in apposition with the heel must be parallel in each case, as a slight inclination in either direction would mean an error in the measurements.

THE TRANSPORTATION OF SKIN FLAPS FROM ONE PART OF THE BODY TO ANOTHER AND FROM ONE INDIVIDUAL TO ANOTHER.*

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Among the most ancient and best known surgical procedures which have been handed down to us are the classical methods of repairing defects in the integument by means of the transference of portions thereof from one part of the body to another. These methods are so familiar that a discussion of them at this time would be not only out of place, but foreign to the purpose of this paper. We will limit ourselves, therefore, to a consideration of those methods alone which have to do with a transfer of skin flaps from one part of the body to another, without the preservation of the original blood supply to those flaps. We shall also exclude from consideration those methods which deal only with the skin itself, in whole thickness or in part, such as the well-known procedures of Reverdin, Thiersch, Wolff-Kraus, etc. We wish to consider that class of case in which it is desirable, in order to repair losses of substance, to transplant something more than the skin, *e.g.,* the subcutaneous fat, fascia, periosteum, etc., as the case may be. Obviously the range of applicability of these latter methods is limited, as the advisability of retaining the original blood supply where possible is so apparent as to need no further comment. Now and then, however, a case presents itself for relief, in which owing to the particular location, or to such extensive losses of substance from trauma of one sort or another, chiefly scalds or burns, that it is impossible to make use of the older methods, because of lack of sufficient or suitable tissue in the immediate neighborhood of the part to be restored.

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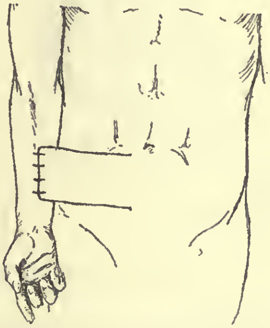
* Read before the American Surgical Association, June 5, 1909.

Such a condition was present in the person of Roberta M., a girl of seven, who was referred to me by Dr. Rees of Charleston, South Carolina. In this case, owing to extensive burns involving the upper anterior portion of the body, the chin was drawn down upon the chest, and the lower part of the face frightfully scarred and disfigured. The lower lip was entirely missing, except for the mucous membrane which was everted, exposing the lower teeth and gums. Saliva was continually drooling from the mouth. The front of the neck, chest and upper extremities were covered with dense cicatrices which rendered it manifestly impossible to obtain suitable skin flaps from anywhere in the vicinity. In our extremity, we finally hit upon the following plan as the only one which seemed at all feasible.

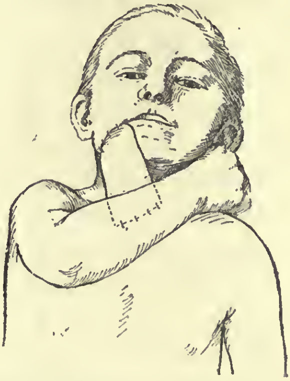
FIG. 1.



Transporting the skin and subcutaneous tissue from the abdomen to the forearm.

A flap six by four inches, with its base toward the middle line was dissected up from the anterior surface of the abdomen. This flap included the skin and subcutaneous tissue down to the aponeurosis of the rectus and external oblique muscles. An incision four inches long was then made upon the anterior surface of the forearm. The free border of the abdominal flap was inserted into this incision and the skin edges carefully united. Gutta-percha tissue was placed over the denuded surface of the abdomen after the edges had been approximated as closely as possible by other silk sutures. The arm was fixed to the patient's side with a broad strip of adhesive plaster, passed around the arm of the patient and then around her body. The arm was left in this position for two weeks. The dressing was then removed and the circulation in the flap found to be good throughout. The pedicle of the flap was now divided, severing it from its abdominal attachment. The arm was then flexed and the patient's hand brought up to and placed upon her head, allowing the free end of the flap to be adjusted to the cheek, which had been freshly denuded for this purpose, after reflecting upward the flap of everted mucous membrane. The skin flap, now receiving its blood supply from the forearm, was fixed in place by sutures between its free border and the skin of the cheek and left in place for another two weeks. At the end of this time, the circulation having become established between the cheek and the flap, its attachment to the forearm was severed, and the repair of the lower lip completed by attaching the mucous membrane to the upper free border of the abdominal flap which now composed the lower lip. A few sutures were placed in the lower edge of the flap attaching it to the skin of the neck. Care was taken to avoid any tension or any more interference with the circulation than was possible. A slight sloughing of the flap occurred at one corner but not enough to affect materially the result, which in the end was most satisfactory. Massage of the new lip was begun as early as the healing would allow, and aided much in loosening up the surrounding tissues.

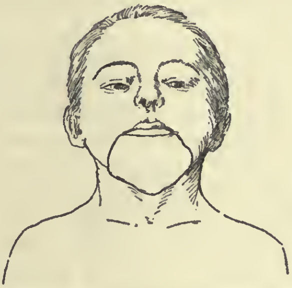
FIG. 2.



Transporting the flap from the forearm to the cheek.

I had occasion to make use of this same procedure in another case very similar to the one just reported. This patient, a child of four and one-half years, had been severely burned about the lower part of the face and upper part of the body in front, and presented a condition almost identical with the case just reported. Exactly the same procedure was carried out. Here, however, the result was not so satisfactory owing to the youth and extreme restlessness of the child. Considerable sloughing of the corners of the flap occurred, although the central portion took nicely and materially improved the patient's appearance. Our experience with this second case and a subsequent one to be referred to later, leads us to believe that such operative procedures as these requiring fixation of the parts, are not applicable to young children. Extreme youth, therefore, we would regard as a definite contra-indication to these operations.

FIG. 3.



The flap fixed in its final place, restoring lower lip and covering chin.

In looking over the literature of the subject, the only references I can find to similar operations are as follows:

In 1888 Dr. G. F. SHRADY of New York, in a personal communication to Sir W. McCormick and reported by him, gives an account of a very ingenious method by which he was able to cover up a "most unsightly gap in a girl's cheek. The arms are folded in a comfortable manner. A suitable-sized flap is dissected up from the anterior surface of the arm with its base either up or down, as desired, and the free end of the flap is stitched into a slit made for the purpose in the radial side of the forefinger. Later the flap is cut loose from the arm and then transported by the finger to the desired locality. This case resulted very satisfactorily."

So far as I am aware, this case was never published elsewhere by Dr. Shrady.

In 1895 Dr. W. S. Halsted reported to the Johns Hopkins Hospital Medical Society a method which he had made use of in a patient suffering from extensive burns over the chest, neck, and arms, in whom he had transferred a skin flap from the back and side of the neck around to the front. Dr. Halsted characterized his method as a "waltzing" of flaps and described it as follows: "None of the original attachments of the last flap which we used have been preserved. The flap has twice been twisted upon itself, first upon a small pedicle of skin (original tissue we may call it), and secondly upon a little broader pedicle of cultivated cicatricial tissue. The flap has probably made a complete revolution."

The result in Dr. Halsted's case was most satisfactory.

In 1901 STEINTHAL reported an operation almost identical with the one performed by us. The operation in his case was done "to relieve a very extensive loss of skin from the face which had been excised to relieve an extraordinarily progressive lupus. Attempts had previously been made by means of the Thiersch method to relieve the deformity. The results, however, were not satisfactory. The greater portion of the nose had been destroyed and it was necessary to do a complete rhinoplasty. The surrounding skin being useless for this purpose, it was necessary to secure a flap from elsewhere." In order to do this, Steinthal cut from over the sternum "a tongue-shaped skin-periosteal flap of suitable size. After cutting and preparing the flap, the breast wound was almost closed with sutures, and the broad edge of the flap grafted into the forearm through a corresponding incision made over the lower end of the radius. The flap was sutured into place, and the arm fastened in a comfortable position by a bandage. The flap was kept from drying out by a thick boric ointment dressing. Four days later the nourishment bridge on the breast was cut through. A few days later the flap, being at this time well nourished, was attached to the root of the nose and the arm fixed against the head in a comparatively comfortable position, with plaster of Paris bandages. After ten days, the flap was separated from the arm and a new nose made from the hanging flap, which was now luxuriantly granulating. The result was most satisfactory, some trimming up of the flaps being necessary later."

These reported cases demonstrate beyond doubt the feasibility of the method and establish the principle that in selected cases where for one reason or another it is impossible to secure flaps in some one of the usual well recognized methods, use may be made of this principle with a fair prospect of success.

In rare instances, however, the conditions may be such that it is impossible to make use even of this method which has just been described. In such cases where one cannot secure suitable flaps from the patient himself, one is forced to look elsewhere, namely, to the person of another. Such a case presented itself to the writer since the first portion of this paper was written.

The patient was a girl 5 years of age, also from Charleston, South Carolina, who came to me through the satisfactory result obtained in the first case just reported. This child had been run over by a street car some months previously. The right leg had been so badly injured as to necessitate amputation at about the middle of the thigh. The left foot also had been badly crushed and the integument of the foot had sloughed off, leaving the foot entirely devoid of skin up to the malleoli. The child who, at the time of the accident had been in robust health, was now, owing to the accident and resulting disturbances, much reduced. Attempts had been made by her physician to cover the foot with Thiersch grafts, but unsuccessfully. These grafts had been cheerfully given by an older sister of the patient, and had been cut from her thigh.

Owing to the poor condition of the patient, and the fact that one leg had been lost, and that there was no possible chance of securing flaps from the other, nor, indeed from any other portion of the patient's body, it was decided to attempt the direct transplantation of skin flaps from another person. The idea was proposed and the same sister who had previously given the Thiersch grafts volunteered to supply the other. The method of procedure was as follows Under ether, a flap, seven by five inches, consisting of skin and subcutaneous fat and having its base upward, was raised from the outer surface of the donor's thigh. The patient's foot which had been freshly denuded for the purpose was inserted between the flap and the raw surface left after it had been dissected up. The flap was large enough to cover completely the plantar surface of the foot and was held in position by stitches through its free border and the edge of the skin above the patient's heel. A few interrupted sutures were placed on either side, wrapping, as it were, the flap around the denuded sole of the foot of the patient. Patient and donor were held in this position by adhesive strapping and plaster of Paris bandages, holding the legs of the two in apposition and parallel to each other, with their heads in opposite directions. They were put to bed with the head of one at the head of the bed, and the head of the other at the foot. The two were surprisingly comfortable, and I feel sure the flap would have taken well, had it not been necessary, owing to the extreme restlessness of the patient, who as was said before, was only five years of age, to cut them apart earlier than had been intended. She was a spoiled child and wilfully added to the pain and discomfort of her older sister by moving her foot as much as possible when she felt so disposed. The two were kept tightly bound together in this fashion for ten days. I did not feel justified in keeping them together longer, owing to the needless pain inflicted by the patient upon her sister, who bore it most heroically. At this time the circulation in the flap appeared excellent, except at the very tip, and it had firmly adhered to the foot of the patient. Upon dividing its pedicle, however, after a few days the circulation began to show signs of failing, and the flap softened and soon completely disappeared.

Here again, as has been previously noted in the beginning of this paper, owing to the extreme youth and restlessness of the patient, the operation was prevented from being a success. The idea, however, I believe to be perfectly feasible and, under proper conditions, capable of being carried to a successful issue. I had supposed that this was a unique case, as no reference in the literature could be found to any similar one. We did find, however, that in 1865 Hamilton had suggested the possibility of such a thing, and had actually proposed it in one case, but no one could be found who would furnish the necessary tissue. A personal communication from Dr. F. B. Lund, of Boston, accompanied by a photograph reports a similar case performed by him in August, 1908. I quote as follows:

Michael M., aged 19 years, single, had his foot caught in an elevator, so that the entire sole of the foot was crushed off. He was admitted to the City Hospital on August 4 and on August 25 had a perfectly clean granulating area covering the entire sole of the foot from the base of the toes to the tip of the heel. He had a fairly large foot, and it seemed to me that if a sufficiently large flap were taken from the other leg it would

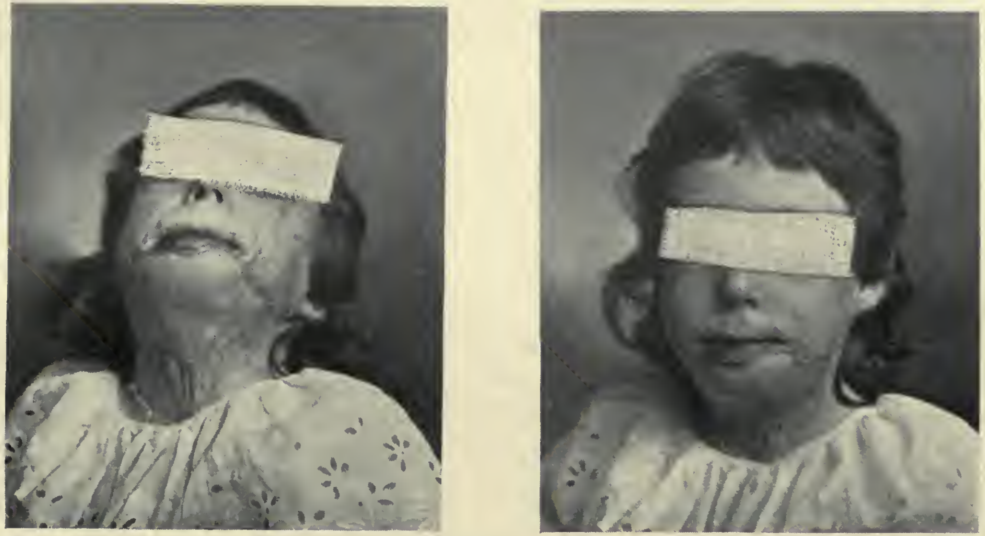


Fig. 4. Fig. 5.

Case I.—Showing result after operation.

denude it too much, so the experiment was tried of taking a flap from the abdomen of his brother, who was about his age and size. The brother was placed in a bed which was brought up to the foot of Michael's bed, so that the sole of Michael's foot lay across his brother's abdomen. On August 25 they were both etherized, Michael's foot was curetted and a flap turned up from his brother's abdomen below the umbilicus, the long axis being transverse, of course, to the body. The flap was sutured to the inner side and posterior and anterior borders of the raw surface on Michael's foot. Then the brother was bolstered up and confined by straps attached to the bed in various directions with a sheet across him, and Michael's foot was tied down so that he could hardly move it. The use of plaster of Paris was thought of; but it presented some difficulties, so the idea was abandoned.

When the boys came out of ether, they began to be very uncomfortable and used language of the most violent kind toward each other, and almost came to blows. The following day, the brother had a temperature of 103, rapid respiration and signs of consolidation at the base of one lung. He was very uncomfortable in his position, and the question of cutting them apart was considered, but it was decided to leave them together. The foot was dressed two days after the operation, and looked healthy. The brother from whom the abdominal flap had been taken was very uncomfortable and hard to manage. He refused nourishment and grew very weak, and on September 4, I did not dare to leave them together any longer, and although it was only the sixth day after the operation, I cut off the abdominal flap. It looked healthy, and bled a little from the cut edge, but in a few days began to get gangrenous and finally melted away.

Although the results in both Dr. Lund's case and my own were not satisfactory, still, as will be observed, the conditions in each case were very unfavorable to the production of a satisfactory result. Under proper conditions, I feel sure it will be found entirely possible to transfer in this manner from one individual to another, flaps of desired size and thickness.

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MASSIVE KELOID OF FACE AND HANDS.*

BY CHARLES A. PORTER, M.D.,

OF BOSTON, MASS.

Surgeon to the Massachusetts General Hospital.

This remarkable case of keloid of the face and hands is reported chiefly to put the photographs upon record, and to show the present result after numerous plastic operations, skin grafts, and spontaneous healing. Although the X-rays were conscientiously tried over several periods there was no benefit.

This patient entered the Massachusetts General Hospital, on March 10, 1905, in the service of Dr. A. T. Cabot, whose assistant I was at that time. Dr. Cabot performed the first operation on March 20, 1905; since then Dr. F. G. Balch has operated five times and I myself six times.

History.—Stephen Calabro; Italian; aged 19. Ten months ago patient's face and hands were severely burnt in an explosion in a fireworks factory. He was treated for three months at the Quincy Hospital. Five months ago the region about one of his eyes was skin-grafted at the Carney Hospital, since which time the scars have been steadily growing. *Examination*: Patient's face presents massive keloid extending from the hair-line on the forehead over the whole face, including both ears. A small portion of the right cheek is visible, the eyes appearing as slits in the midst of the exuberant overgrowth. Slight impairment in hearing; vision in left eye interfered with; mouth can only be opened half an inch. There is excessive keloidal growth on the backs of both hands and lower third of the forearms, the fingers being hyperextended, twisted, and distorted. In numerous places the keloidal tissue is eroded, with some foul discharge from the sulci between adjacent lobules.

Operation, March 20, 1905, by Dr. A. T. Cabot; rectal anæsthesia. Incision over the symphysis of the lower jaw, down to the subcutaneous tissue, with removal of keloid over right side of chin and part of cheek. Several necrotic areas were found deep in the tissues, in the transitional zone between keloidal and normal subcutaneous fat. On the left, the keloidal mass overhanging the lower jaw was excised, opening an abscess cavity which contained several drachms of pus. Dry dressing; daily X-ray treatment until moderate degree of dermatitis was induced. By April 4 the epidermis was growing very slowly, but there was no return of keloid; distinct improvement in the mobility of the lower lip was evident. On April 18, a typical erysipelas developed which lasted about ten days.

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* Read before the American Surgical Association, June 5, 1909.

Operation May 31, 1905, by Dr. Porter. The thick plaques of keloid were dissected off in masses from cheeks, forehead, nose, left ear, and lips; in many places down to the subcutaneous tissue. Hemorrhage was very free. This operation required a dozen to fifteen knives, as the tissues were so hard. There was profuse discharge of pus for many days, but at the end of a fortnight the epidermis began to spread in rapidly, and the patient was discharged on June 14 much relieved.

Re-entry December 20, 1905. The keloidal masses have returned but not to their former extent. The left eye is obscured and the eyelids are deformed by scar tissue. A keloid the size of a silver dollar has formed upon each shoulder and another one above the sternoclavicular notch.

Operation December 29, 1905, by Dr. Porter. The recurrent keloid on the right side of the face was shaved off. Wedge-shaped piece cut out from right eyebrow and the edges brought together. A similar wedge from beneath the lower lid was excised and sutured. The keloid at inner canthus of the eye was removed and skin-grafted from the leg. Other grafts were applied over the raw tissues about lower jaw. The grafts took well and by January 17, 1906, only a small area over the lower jaw on the left was uncovered by epidermis. On January 23, more pin-point grafts applied to granulating areas on face. February 1, 1906, another attack of erysipelas of both face and hands.

Re-entry March 6, 1906. Face considerably improved; left eye open and useful, though there is slight cicatricial ptosis and ectropion.

Operation March 14, 1906, by Dr. Balch. Bilateral operation for ectropion; excision of scars with Thiersch grafts from thigh.

By March 28 both grafts, which had taken, showed a tendency to shrink with slight recurrence of ectropion. Keloid forming on area from which graft was taken from thigh.

Operation April 2, 1906, by Dr. Balch. An attempt was made to separate the fingers by excision of the dense cartilaginous-like tissue. Plastic operations were done; the thumb partially freed from scar; but it was impossible to secure proper skin flaps for the denuded area. Hand was dressed with rubber tissue and dry dressing. On April 4 raw surfaces grafted under cocaine, but grafts failed to grow.

Operation April 9, by Dr. Balch. A large crescentic area of scar was removed from beneath the left lower eyelid; a Wolff graft was removed from the right side of chest and fitted to the denuded area. Graft took well under the left eye. In the meantime, there was considerable recurrence of the keloid over the face.

On May 4, under ether, Dr. Porter excised two crescents of the keloidal tissue which overhung both eyes. The wound was then sutured, raising both eyebrows. The recurrent keloids underneath the eyes were completely dissected out with a large keloid which covered the whole right cheek. The growth over the nose was removed down to the subcutaneous fat. Two brothers and a friend were then circumcised and the prepuces used for Wolff grafts, the grafts having been previously punched to allow for drainage, and then sutured in position over all denuded areas. These heterogeneous grafts grew well at first and by the end of the fourth day showed definite evidence of re-established circulation, but on the ninth day all turned black and in a few days separated. On May 28, Dr. Balch rubbed the granulations with gauze and then applied three Thiersch grafts, which, however, failed to take. During the summer the X-rays were used again. The keloidal tissue beneath the lower lids contracted steadily but showed little tendency to increase outward.

In March, 1907, Dr. Balch did plastic operations on two or three of the fingers, separating the webs and loosening up the index finger, and again in April, attempted to gain flexion of the thumb by freeing the extensor and flexor tendons and removing the head of the proximal phalanx of the thumb. Primary union, but no marked improvement in motion.

On June 24, Dr. Porter dissected out the cartilage of the

Fig. 1.

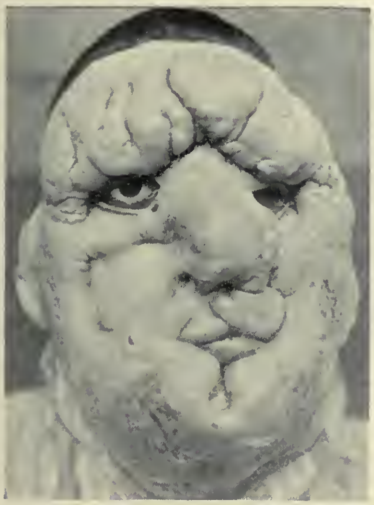
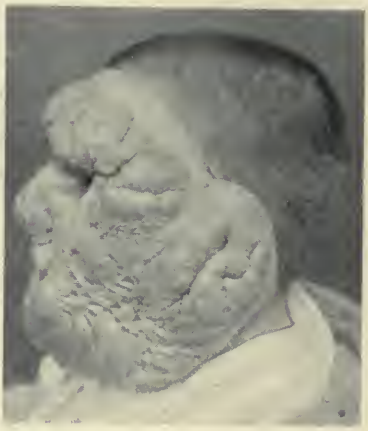
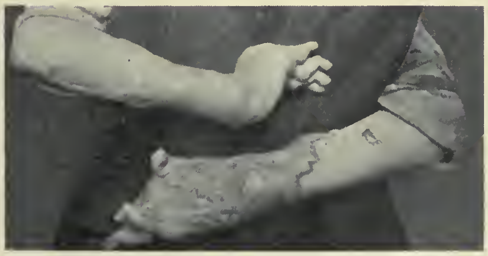


Fig. 2.



Condition on entrance to hospital, March 10, 1905.

Fig. 3.



Condition of hands, March 10, 1905.

Fig. 4.

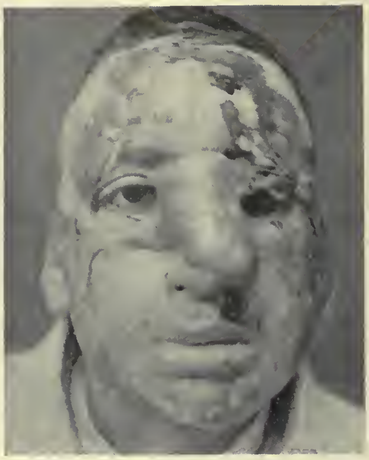
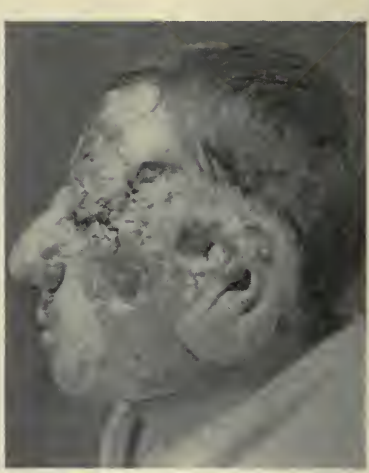


Fig. 5



Condition, May 27, 1905.

Fig. 6.

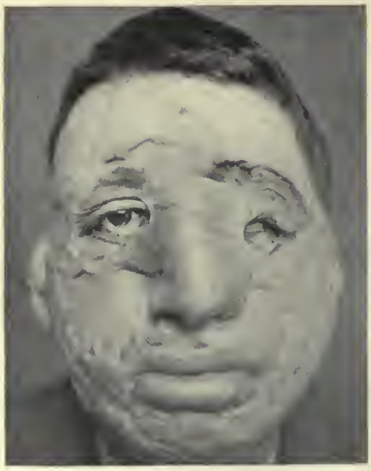
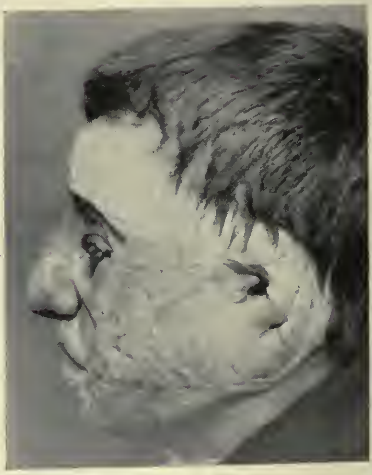


Fig. 7.



Condition, November 4, 1905.

Fig. 8.

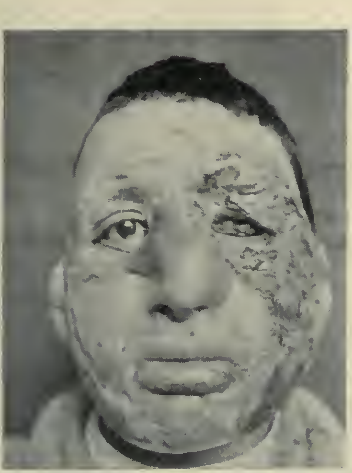
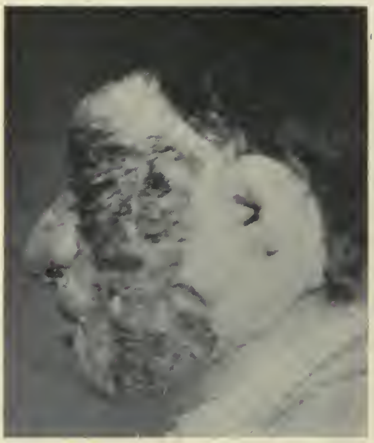
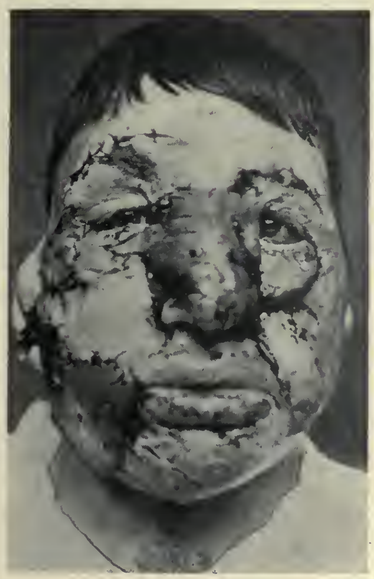


Fig. 9.



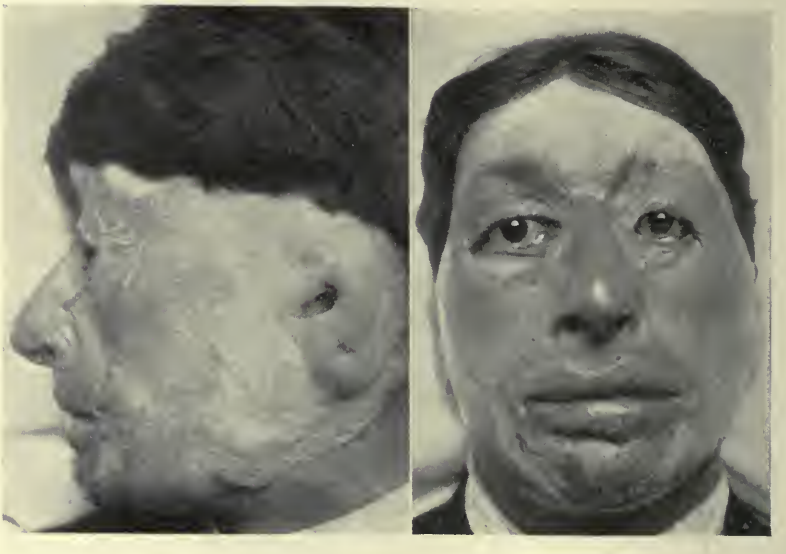
Condition, January 6, 1906.

Fig. 10.



May 6, 1906, showing result of excisions and preputial grafts on May 4, 1906.

Fig. 11. Fig. 12.



Present condition, June 1, 1909.

right ear, which was involved in the keloidal growth; Thiersch grafts were applied. The left ear was also freed, as was the lower lip. Skin grafts were applied to all raw surfaces, and the mass above the suprasternal notch was excised and the edges sutured.

Operation July 12, 1907, by Dr. Porter. The cicatricial tissue which was causing hyperextension at the right wrist was removed and the area skin-grafted. The thumb was freed and a graft applied between it and the index finger. The webs which formed between the middle and adjacent fingers were pierced obliquely from behind forwards and downwards, and through the opening a piece of rubber dam was drawn. The right ear was freed at its top and the raw surfaces were skin-grafted. By August 15 the skin had grown about the rubber setons at the base of the fingers, and the web was cut under cocaine.

On August 24, 1908, Dr. Porter removed a thick mass of scar tissue holding the ear to the scalp. Another operation was performed for recurrent ectropion of the left eye, a crescentic excision being made and a Wolff graft from the thigh applied; graft took well.

On September 14, 1908, re-entered; operation by Dr. Porter. Further freeing of the right ear and removal of keloidal masses; areas skin-grafted and the patient discharged September 30, 1908.

Résumé.—After many operations, the photographs show the present result. There has been a gradual but distinct abatement of the tendency to form keloidal tissue. The forehead is covered by shiny, movable skin, resulting partly from natural healing and partly from skin grafts. There is some keloid about the deformed ears, but both show evidence of their presence. The nose and cheeks are fairly normal, but there is still some ectropion in spite of the numerous operations. The hands have been improved so far as ability to grasp objects with the thumb is concerned, but dorsal hyperextension of the fingers still persists, as shown in the photographs. X-rays seem to have been of no value.

TRANSACTIONS

OF THE

AMERICAN SURGICAL ASSOCIATION.

Annual Meeting held at Philadelphia, Pa., June 3, 4, 5, 1909.
The President, Charles B. G. de Nancrède, in the Chair.

I. ADDRESS OF THE PRESIDENT: THE END RESULTS AFTER TOTAL EXCISION OF THE SCAPULA FOR SARCOMA.

Dr. Charles B. G. de Nancrède, of Ann Arbor, Mich., gave the Annual Presidential Address; his topic was as named above. For the address in full see page 1.

II. CHRONIC INTESTINAL STASIS.

Mr. W. Arbuthnot Lane, of London, Eng., read a paper on Chronic Intestinal Stasis, for which see page 190.

Dr. J. C. Bloodgood, of Baltimore, called attention to the X-ray examination as a method of diagnosis which he thinks will be more frequently used in the future. He presented a rough sketch of the condition found in a recent patient, a full report of whose history will be published later; he also referred to a former case which is now well for two years without having had a resection.

Dr. T. W. Huntington, of San Francisco, considered the principal significance of the subject under discussion was the idea of the prevention of the conditions. He was of the opinion that these cases of enteroptosis, bearing especially upon the large bowel, could be avoided by careful attention in early life to the emptying of the bowel, and that this accumulation is due usually to a definite cause giving rise to sufficient irritation to interrupt the peristaltic wave, as, for instance, in cases of occult appendices.

Dr. Arthur Dean Bevan, of Chicago, was of the opinion that Mr. Lane's suggestions were rather radical. He said he should insist upon a condition which should be described absolutely as that of intestinal obstruction, before he would feel warranted in undertaking such an operation as an anastomosis or the removal of a part or the whole of the colon. He considered the subject of chronic constipation one which should be dealt with jointly by the internist and the surgeon.

Dr. J. F. Binnie, of Kansas City, said that in a number of these cases he had done a cecostomy with very fair temporary results, although he has been unable to learn the ultimate results.

Dr. John B. Roberts, of Philadelphia, stated that he understood Mr. Lane to advocate surgical operations in these cases only when all other means had failed, and he then believed this surgical interference should be prolonged and radical.

Dr. Maurice H. Richardson, of Boston, called attention to the fact that he had reported two or three cases of chronic intestinal obstruction. He believes the surgery of the large intestine should not begin by at once operating for obstinate and chronic constipation, although early exploration in cases of chronic constipation will relieve many pathological conditions which can be treated as easily as the simple incision of a band. It is his firm opinion that an exploration should be made in all cases of obstinate intestinal obstruction, whether called constipation or obstruction, and that such serious and dangerous operations as the complete resection of the large intestine should be avoided.

Dr. Wm. B. Coley, of New York, said that while believing in conservatism he did think that too often these cases were allowed to go too far without surgical interference. He called attention to the fact that nine such cases operated upon for volvulus of the sigmoid at the Massachusetts General Hospital had terminated fatally. He reported a case of his own operated upon on the ninth day for acute obstruction. The abdomen was opened under cocaine and the giant sigmoid fastened to the abdominal wall, and a large amount of liquid fæces evacuated through a tube in the bowel. In a week the patient began to have natural passages by the rectum; at the end of two weeks the wound had healed. The symptoms then reappeared, and in a short time he had increasing distention. Dr. Coley did not think it wise to resect the sigmoid but introduced a small silver tube into an opening for the escape of gas, and this the patient has been wearing for a year.

Mr. Lane, concluding the discussion, said that in the discussion no mention had been made of what he considered the most important points in the paper, the toxic results of autointoxication. He believes it is growing to be more the general opinion that the intestinal tract is no longer to be only treated by drugs from above or enemas from below.

III. THE RELATION OF MESENTERIC DISTORTION TO INTESTINAL OBSTRUCTION.

A paper upon the above subject, by Dr. Joseph D. Bryant, of New York, in the absence of the author, was read by title. It is published in full beginning at page 229.

IV. THE FECAL ORIGIN OF SOME FORMS OF POSTOPERATIVE TETANUS AND ITS PROPHYLAXIS BY PROPER DIETETIC OR CULINARY MEASURES.

Dr. Rudolph Matas, of New Orleans, read a paper with the above title, which he summarized as follows:

1. Notwithstanding the vast increase in our knowledge of the etiology, pathology and prophylaxis of tetanus since the discovery of the drumstick bacillus of Nicolaier, twenty-six years ago, a certain—not full determined— number of postoperative deaths from this infection occurs in seemingly clean surgical cases, a circumstance which has not been satisfactorily accounted for.

2. While it has been fully and irrefutably demonstrated that the regional liability of the exposed parts of the body to tetanus (*i.e.,* feet, hands, legs, forearms, arms, face, neck, etc.) is directly proportional to the degree of surface contact with tetanus-bearing (tetaniferous) matter (earth, manure, dust), the origin and regional distribution of accidental and postoperative tetanus in the concealed parts of the body (protected from surface exposure) has not been sufficiently investigated or recognized. Surely not sufficiently insisted upon in accounting for postoperative deaths in which the rules of surgical asepsis have been apparently well observed.

3. Abundant experience has shown that while the risk of tetanus infection can be absolutely eliminated in all operations upon sterile tissues in which a rigorous postoperative asepsis can be maintained until healing has occurred, this liability cannot be removed in those regions in which postoperative asepsis cannot be secured.

4. In order of importance next to the feet and hands and other exposed parts of the extremities, the injuries and surgical operations in those regions of the body which are most exposed to fecal contamination, are the most liable to tetanic infection. In this category we will place the anorectal region, perineum, female genito-urinary tract, male genitals (especially scrotum), lower pelvic region (including buttocks, sacrococcygeal region), groins, thigh, knee, upper leg, on their posterior surfaces especially; after operations on the intestines, artificial anus, etc., in all of which postoperative fecal contact is either constant or unavoidable on account of proximity to the intestine. In considering this topographical distribution we are excluding the direct but unconscious transmission of fecal matter to distant parts of the body by the soiled fingers of the patient himself or of his attendants.

5. The careful attention to the sterilization of instruments and the disinfection of the hands compelled by the rules of modern surgical, obstetric and veterinary practice, have enormously reduced the liability to tetanic infection, even when those parts of the body are involved which are most exposed to fecal contact, by eliminating the direct inoculation of wounded surfaces with contaminated instruments and hands. However, the occasional postoperative deaths which occur from time to time in the practice of competent and clean surgeons clearly point to another source of danger which is not dependent upon defects of technic or contaminated material (*e.g.*, imperfectly sterilized catgut), but to other sources of infection outside of and apart from the operative act itself, which have not been adequately appreciated.

6. This hitherto unrecognized or disregarded factor in the causation of postoperative tetanus, at least in regions liable to fecal contact, is the direct contamination of the alimentary canal and its contents with living tetanus bacilli and their spores, swallowed in raw, uncooked vegetables, berries and other fruits which are cultivated in fertilized or manured (*i.e.*, tetanized) soil (Robinowitsch, Kolle and Hetsch, Miquel and Cambrier, Kolle and Wassermann, Thalmann, Hecker, et al.).

7. It may be a mere coincidence, but it is a fact, that in all the cases of postoperative tetanus occurring after operations in regions liable to fecal contact, which have been investigated by the author (two in his own practice), the patients had eaten

copiously of uncooked vegetables immediately before the operation. The vegetable menu in these cases correspond with the laboratory findings in regard to the vegetables found most frequently contaminated with tetanus germs and spores, viz., celery, lettuce, chicory, watercress, cabbage (cold slaw), radishes, turnips, carrots, tomatoes and other green vegetables, strawberries, blackberries and other berries and fruits which are grown in the soil or brought in contact with it and which are largely consumed raw in an unavoidably contaminated state.

8. The tetanus bacillus and its spores are known to survive the passage through the intestinal canal of the domesticated animals, especially the herbivorous horse and cow, and the dung of these animals is a perpetual culture medium for the tetanic bacillus, swallowed constantly with the grass of the pasture and the fodder of the stable; not only are the bacilli ejected alive, but their virulence and activity are probably intensified by their temporary residence in the favorable conditions of the lower intestinal tract (Sormani). This survival of the tetanus germ in a virulent state is fully demonstrated by the experiments of Sormani, Sanchez Toledo, Veillon and Hoffmann, et al., who demonstrated that the diluted excrement of the horse and cow, injected subcutaneously and otherwise, will kill rabbits in from five to six days with all the symptoms of this disease. These and other authors have fully demonstrated that the spores of the drumstick bacillus resist the action of the digestive juices; it has also been demonstrated that the tetanus-laden fæces of the healthy horse and cow are capable of producing fatal tetanus when brought in contact with wounded surfaces in these animals.

9. In view also of the fact that 5 per cent. of all normal men harbor the tetanus bacillus or its spores in an active state in the intestinal canal, and that the percentage of contaminated individuals is increased to 20 per cent. in hostlers, stablemen, dairymen, drivers, etc. (Pizzini), the possibility of tetanus from fecal contact must always be kept in mind, especially when operating upon the anorectal region, perineum and genito-urinary organs of both sexes, in unprepared subjects.

10. The author fully recognizes that the normal defences of the organism against intestinal infection are, in healthy individuals, usually sufficient to protect it, even if the living tetanus bacillus has been freely introduced into the alimentary canal with

the ingested food. It is only through the salutary and preservative influence of the protective mechanism, which largely neutralizes the most virulent infection in the alimentary canal, that we can account for the great numbers who escape when operations are performed in the recognized tetanogenic regions. It is evident, however, that even if tetanus infection is a comparatively rare postoperative sequence, it is well worth the observance of the simple precautions required to avoid this deadly accident. Precautionary measures would be more than justified if only one in ten thousand operative cases could be saved from the almost certain death which follows when this form of inoculation occurs after operation.

11. In accordance with the preceding statements, and his own convictions, the author has taught and insisted in his own practice, since his last and second postoperative death from tetanus (perineoplasty and hemorrhoids) occurred five years ago, that no patient should be brought to operation without antitetanic preparation, whenever an operation is to be performed upon parts in which fecal contamination is unavoidable (hemorrhoids, fissure, fistula, stricture, etc.).

12. This antitetanic preparation is very simple, and consists in: (*a*) purgation, three days before the operation; (*b*) the suppression of all raw, uncooked food, especially green vegetables, berries and other fruit (for the same period of time before the operation). In emergencies when dietetic preparation is impossible, 10 c.c. of tetanus antitoxin are injected subcutaneously at the time of the operation, while the patient is still under the anæsthetic.

Dr. John E. Owens, of Chicago, mentioned a case of a woman past middle age suffering from tetanus; she had received no wound, but two or three days before the attack she had had a tooth pulled. She was fond of working in the garden and was also fond of fresh celery, of which she had been eating freely, and it was therefore thought that her tetanus might have been caused by indulgence in this vegetable.

Dr. Robert W. Johnson, of Baltimore, referred to a paper on this subject of tetanus which he had read at a previous meeting of the association, and said he did not recall reporting a single case occurring from fecal origin, although there were a number of postoperative cases following herniotomies, appendectomies, hysterectomies, etc. These cases were assumed to have been produced by infection through the catgut used. He said that he had seen a case of tetanus resulting from rectal operation where instead of trismus as an early manifestation there were rectal spasms. He considers it surprising, in view of the facts mentioned by Dr. Matas, that he has not more frequently met with cases of tetanus after rectal operations.

Dr. W. H. Hutchings, of Detroit, said he had recently had an opportunity of treating three cases of postoperative tetanus, one of which followed an abortion. In one of the cases, that of a crushing injury to the hand in which a skin-grafting operation was done, the patient did not develop tetanus for a month after the injury; he considers this an evidence that tetanus spores can remain latent for a long time.

Dr. Joseph Ransohoff, of Cincinnati, said that in his experience he had never seen a case of tetanus following a rectal operation. He mentioned a case in the practice of another surgeon, which he had seen, where instead of a trismus there was an open mouth, which he considered a rather rare condition.

Dr. Maurice H. Richardson, of Boston, said he had never seen a case of postoperative tetanus, and considered it a very rare condition. He therefore thought it would be rather a radical procedure to follow Dr. Matas' suggestion of using antitetanic serum in all rectal cases.

Dr. A. G. Gerster, of New York, said that in thirty-two years of surgery he had encountered not one case of postoperative tetanus.

Dr. Beverly MacMonagle, of San Francisco, said that in an experience of over thirty years he had seen but one case of postoperative tetanus, and that was a case of trachelorrhaphy in which catgut was used. In consideration of Dr. Matas' statements he thought his own experience unusual, as he frequently operated among the poor class of Italians, under most adverse conditions in their own homes, and yet had never had a tetanus resulting after operation.

Dr. Edmond Souchon, of New Orleans, referred to a case upon which he operated for hemorrhoids and the patient died on the eighth day from tetanus; also a case in which the cæcum was resected which was followed by death from tetanus.

Dr. Willy Meyer, of New York, mentioned a case of interval operation for appendicitis, after which the patient developed tetanus but made a good recovery. The catgut used was supposed to be the cause of the tetanus, but Dr. Meyer is of the opinion that it might have been caused by what he calls the pseudotetanus bacillus, which is sometimes found in the appendix, according to the literature on the subject.

Dr. F. H. Gerrish, of Portland, referred to two cases of postoperative tetanus, one resulting after ligation of hemorrhoids, and the other after an operation upon a necrosed tibia. It is his opinion that cases of tetanus come in waves, some years it being quite prevalent, and then there being few instances in other years. He will be careful in his future intestinal operations to see that his patients eat no raw food or vegetables for some days previously.

Dr. J. Collins Warren, of Boston, considered tetanus to a certain extent to be a tropical disease, and that latitude exerts some influence upon the growth of the bacillus; also that occasionally it is epidemic.

Dr. Stanley Stillman, of San Francisco, had had no personal experience with tetanus, but remembered being taught by Dr. Lane, a former member of the association, the great danger of tetanus following ligature operations for hemorrhoids, and as a result of this teaching he had always been most careful in the preparation of his patients for operation.

Dr. A. Vander Veer, of Albany, could recall no case of tetanus following operations upon the rectum in his experience. He referred to an editorial regarding the disposal of sewage in Los Angeles and Pasadena, which criticized very severely the method of using the sewage for irrigation of the poor farms and other lands where they raised vegetables which grew above the ground and which are eaten in an uncooked state. He is not at all opposed to the prophylactic dose of antitetanic serum, which he uses frequently.

Dr. George E. Brewer, of New York, saw no objection to the use of the prophylactic dose of antitetanic serum, stating that it was used in all cases of injured hands and feet in the accident department of the hospital with which he was connected.

Dr. Dudley P. Allen, of Cleveland, said that some summers ago at the Cleveland Hospital they had a number of cases of tetanus from the use of the toy pistol; every one of these cases which were opened and packed recovered, but those which were not so treated died early from tetanus.

Dr. C. B. G. de Nancrède, of Ann Arbor, mentioned the fact that there were certain portions of the country where tetanus was practically never encountered, while in other portions it was very prevalent. There is a great deal of it in the country round about Ann Arbor, and there is a standing order to Dr. de Nancrède's internes to give a prophylactic dose of antitetanic serum in all cases where the wound is of a kind likely to lead to tetanus. For eleven years Dr. de Nancrède has been in the habit of warning his students of the dangers of unripe fruit as possible sources of tetanus, and is rather surprised that so few believe in this origin of the disease.

Dr. Robert G. Le Conte, of Philadelphia, reported a case occurring fifteen years ago in the practice of one of his friends. The patient had undergone an operation for the repair of the cervix and perineum, and on the seventh or eighth day developed tetanus, from which she died. He mentioned the fact that the Pennsylvania Hospital of Philadelphia had for many years following the Fourth of July many cases of tetanus to treat, but that since using the immunizing dose of the antitoxin there had not been a single case.

Dr. Matas, concluding the discussion, said that the preparation of the patient to which he referred in his paper was not the preparation preliminary to operation, which most surgeons were very particular about, but a preparation extending back for some three or four days, in order that the bowels might be thoroughly cleaned out with no possibility of a fecal contamination following operation. He believed that where such preparation was not possible it was a wise precaution to use the immunizing dose of the antitoxin. He stated that warm latitudes seemed to predispose to the disease, especially in times of peace, while in times of war it seemed to make but little difference. He suggested that another reason why tetanus was not so prevalent in northern latitudes was that the soil there was not so laden with the tetanus bacillus.

V. THE HISTOPATHOLOGY OF GOITRE.

Dr. Francis W. Shepherd, of Montreal, read a paper in which he gave the results of a microscopical study of over fifty cases of thyroidectomy, for which see page 84.

Dr. William S. Halsted, of Baltimore, stated that at one time he had performed some experiments on dogs for two years at a time, and found that when once the hypertrophy of the glands was produced by the ordinary cause it did not change for at least two years.

Dr. Charles H. Mayo, of Rochester, said that his own cases bore out in the main the report given by Dr. Shepherd, and that the more thyroids he examined the more simply he reduced the pathology of the condition. He looks upon the term colloid, as found in a thyroid, as a complement to the real secretion, and not the secretion itself.

Dr. Rudolph Matas, of New Orleans, spoke regarding the thermic development in operations upon the thyroid glands. He cited the case of a recent patient whose temperature an hour after partial resection of the gland went up to 105.°. He suggested the use in these cases of high temperature, of Blake's tubes in the rectum, by which ice-water is administered in large quantities. This has always been most successful in his hands.

Dr. Francis J. Shepherd added that he found a high temperature after operation chiefly in exophthalmic cases, but in simple goitre it was caused by serum, and when this was removed the temperature would fall.

VI. THE PARATHYROID QUESTION.

Dr. Charles H. Mayo, of Rochester, Minn., read a paper with the above title, for which see page 79.

Dr. John H. Gibbon, of Philadelphia, referred to a case of tetany occurring in a patient from whom he had removed the entire right lobe of the thyroid. The condition developed on the fourth day after operation, became very bad, and the patient's mental condition grew distressing; calcium was conscientiously tried, as was also the feeding of the patient with the parathyroid of beeves, but with no effect. A number of months later the patient was reported as much worse, and then nearly a year later she was said to have practically recovered. Dr. Gibbon did not know the ultimate outcome of the case.

Dr. William S. Halsted, of Baltimore, said that he felt there was practically no danger of tetany following a case operated upon by Dr. Mayo's method. He considers one reason why tetany occurs so seldom is because so infrequently both lobes of the thyroid gland are removed. He cited one case of tetany which was treated most successfully by lactate of calcium.

He also mentioned some experiments upon the parathyroids of dogs, where it was found possible to keep the dogs alive for some time on one transplanted parathyroid.

Dr. Francis J. Shepherd, of Montreal, said he had never seen a case of tetany following an operation upon the thyroid gland. In all cases of partial excision of the thyroid glands he carefully examines for the parathyroids, and frequently finds them embedded in the inside of the gland.

Dr. Maurice H. Richardson, of Boston, said that the only cases of thyroids which he had to deal with were those sent to him from practitioners who were afraid to deal with them on account of their size, and that he had never seen a case of tetany nor a parathyroid body.

Dr. L. L. McArthur, of Chicago, reported a fatal tetany following a case of goitre removal with resection of both lobes, in which the parathyroid bodies, which were demonstrable on the right side, were removed. The patient presented symptoms of tetany on the fifth day; thyroid extract was administered, and he went home with his wound healed and the tetanic symptoms in subsidence at the end of two weeks. Ten days later, or twenty-four days after the operation, having been in the meanwhile around the house, he was suddenly again seized with the tetanic convulsions, and died in ten hours. Dr. McArthur ascribed this to a pure tetany independent of any infective process.

Dr. N. B. Carson, of St. Louis, reported a case of removal of the thyroid gland in which some time later the patient developed an immense keloid along the line of the scar.

Dr. Charles H. Mayo thought that the resemblance to the thyroid gland found by Dr. Halsted in removing the parathyroid gland which had been transplanted in one of the dogs upon which he was experimenting, would show the association of function of these various glands. He said that, as Dr. Shepherd had stated, the parathyroid body was sometimes found in the capsule of the gland, although this was not its usual position.

VII. EXCISION OF THE LARYNX FOR CARCINOMA.

Dr. James Bell, of Montreal, read a paper with the above title, for which see page 92.

Dr. W. W. Keen, of Philadelphia, referred to a paper read by him when he was President of the Association, the title of which was "Total Laryngectomy," no one feature of his method being new, but simply a novel combination. The two features he insisted upon were the exaggerated Trendelenburg position and the avoidance of any preliminary tracheotomy, and the keeping of the patient for two or three days subsequent to the operation in the Trendelenburg position. He stated that his first patient is now well at the end of eleven years, and can be heard at a distance of thirty feet without any artificial larynx.

Dr. George E. Brewer, of New York, stated that the mortality in these cases, according to his experience, agreed with those reported by Dr. Bell, but that he followed a different form of technic. His first case was done nearly eleven years ago, after the method of Dr. Keen. Following that one success he had many disastrous results, in all of which cases he did no preliminary tracheotomy. He now does a preliminary tracheotomy ten days prior to operation, exposes a large amount of trachea, packs with iodoform on either side with a view to creating dense adhesions which act as a bar to the descent of infection. He removes the larynx from below upward, closes the pharynx and does not lift up the trachea. Since following this plan he has had no operative mortality, and the cases have been more comfortable than ever before. With regard to feeding, he introduces a nasal tube in the lower portion of the œsophagus and begins feeding from the start with concentrated foods, just after the patient comes out of ether, and water in six hours.

Dr. N. B. Carson, of St. Louis, suggested that rectal anæsthesia employed in these cases would add much to the comfort and chances of recovery of the patient.

Dr. Roswell Park, of Buffalo, reported a death following laryngectomy. He used subnitrate of bismuth instead of iodoform; the patient did well for two or three days and then died. An autopsy was performed and every particle of mucous surface was found covered with bismuth paste; the bismuth had become mixed with saliva, then with the mucus, and had spread itself over the patient's breathing surface so as to completely choke off all possibility of æration.

Dr. George W. Crile, of Cleveland, reported 20 total laryngectomies, the first 8 performed without fixing the trachea, the last 12 along the lines described by Dr. Brewer. There were 2 immediate fatalities in the first 8 and none in the last 12. The results were quite satisfactory. The first case is living after 16 years; one patient died in 5 years from pneumonia; one living after 4 years; one after 3 years, and the remainder are all recent operations.

Dr. Bell said that he thought it unnecessary to fear infection extending down the neck if the patient were kept in the Trendelenburg position and the wound not too completely closed. He considered the feeding question most important, but does not look with favor upon the performance of a gastrostomy, as suggested by some operators.

VIII. FURTHER OBSERVATION ON TRANSFUSION; WITH A NOTE ON HÆMOLYSIS.

Dr. George W. Crile based this further report on transfusion on recent experience. The vein makes a better cuff than the artery, and he emphasizes the importance of dilating the end of the artery before drawing it over the cannula.

It has been found, contrary to common belief, that kinship is of no special advantage, any normal blood doing as well. The condition of the heart is the most important consideration in transfusion. When there is a heart lesion with compensatory hypertrophy the muscle is working near its maximum and its normal factor of safety may be lost.

In deep anæmia there is impairment of the heart muscle. If in such a case blood be transfused rapidly and under full pressure, there is striking improvement, but great caution is necessary, for dilation may follow with stagnation of the circulation. This condition is met by carefully adjusting the rate of flow and by noting the first sign of dilation, when the flow is checked or stopped. Cardiac stimulants and observation of change in heart dulness are the effective prophylactic measures. The most effective active measure consists in the rhythmic compression of the chest, which forces the blood from the thorax, improving the circulation.

As to clinical results there is no modification of previous conclusions, viz.: In pernicious anæmia, toxæmia, certain drug poisoning, leukæmia, Hodgkin's disease, carcinoma and uræmia, no benefit has been observed. A case of hyperthyroidism was apparently benefited. A case of pellagra, transfused from an immune donor had a rapid convalescence. If done early, transfusion is a specific for an acute hemorrhage. In suitable cases it has been of great value in the prevention and relief of shock. Certain amount of encouragement has followed transfusion in tuberculosis.

In operative surgery, cases where hemorrhage and anæmia exist, or where the patient is reduced by disease or starvation so that an operation is out of the question, transfusion will make it possible. The technic of transfusion is exacting, and may be difficult, and is rarely necessary in the routine surgical work.

In regard to hemorrhage, it is, first, but one form of action between the blood of one individual and that of another; secondly, that if there is hæmolysis *in vitro* it by no means necessarily follows that there will be hæmolysis *in vivo.* This is especially so in tubercular cases where hemorrhage has occurred *in vitro,* but transfusion was performed with no unfavorable results.

Hæmolysis is a valuable aid in the diagnosis of acute tuberculosis, the reaction occurring more frequently than in cancer. In the latter, hæmolysis usually occurs in the earlier stages, rarely in the later.

Dr. George E. Brewer, of New York, said that one remark of Dr. Crile's would be appreciated, and that was that even direct transfusion is attended with a good many mechanical difficulties. He thought one found transfusion much more complicated when tried upon a human being than when done on animals. He has devised some glass tubes which if placed in boiling paraffin before introduction, the blood will not clot on them, thus assuring a steady stream from the donor to the donee.

Dr. William S. Halsted, of Baltimore, referred to experiments made some thirty years ago, in centripetal transfusing of the animals, and wished to know Dr. Crile's opinion of this method of transfusion where the patient had a weak heart. He also stated that somewhat the same method as suggested by Dr. Brewer had been tried at Johns Hopkins Hospital with silver tubes. He spoke of another method of transfusion, which, while not considering it as good as Dr. Crile's, he thought still had its uses. Two tubes are used, one for the vessel of the donor and one for the vessel of the donee, and these can be quickly joined together.

Dr. John H. Gibbon, of Philadelphia, said he had used Brewer's tubes with a great deal of satisfaction, while he had not found Crile's so easy of manipulation.

Dr. David Barrow, of Lexington, wanted to know in cases where shock was dependent simply upon the question of centripetal embarrassment, whether Dr. Crile had ever been able to demonstrate the value of the transfusion of blood.

Dr. Crile said he wished to recommend Brewer's method, which seemed simpler than his own. In reply to Dr. Halsted he stated that in his opinion centripetal transfusion was of the utmost importance in cases of weak heart. With regard to Dr. Barrow's query he stated that the transfusion of blood overcomes to a great degree the circulatory depression of shock.

IX. TUBERCULOSIS OF THE PERICARDIUM CURED BY INCISION AND DRAINAGE.

Dr. Charles L. Gibson, of New York, stated that operation, if any, for the relief of tuberculous pericarditis must be rare, but the fact that a cure was obtained in the case he presents makes it worthy of record.

The case was as follows: Male, negro, aged 26, whose past history was without features except for an ischiorectal abscess three months ago. Family history for tuberculosis is negative. For past two months has had a heavy cough with slight expectoration; for past two weeks dyspnœa has been so bad that he could not lie down, sleeping in a chair; swelling of the feet noted six days ago. Physical examination showed a man of fairly large frame, fairly well nourished; breathing with some difficulty and with an expiration grunt. Heart percusses 1½ inches to *right* of sternum and 6 inches to left. Sounds of poor quality and hard to hear. Considerable bronchitis. Five days after admission pericardium was aspirated in fifth space and 18 ounces of opaque, yellowish fluid were obtained. Finally it was decided, as there was not marked improvement in the patient's condition, that operative interference was indicated. Attempts were made at local anæsthesia, but these attempts, because of the lack of self control of the patient, were found in vain. Chloroform was then given to the point of unconsciousness, followed by ether. An incision was made in the long axis of the left fifth cartilage, a bit of the rib and also the fourth cartilage removed. The greatly distended pericardium was seized between two Kocher clamps and a two-finger incision gave issue to a great volume of pus, probably a quart. The pulse was perceptibly weakened by the flow, and it was therefore blocked. The sac must have contained three quarts. The pericardial edges were sutured to the soft parts and a rubber drainage tube passed into each lateral cul-de-sac. The subsequent drainage was profuse. Since operation the patient's condition has been poor, and he is now again in the hospital as an inmate of the tubercular ward, the presence of a tubercular process in the lung being now manifest; tubercle bacilli were not found till recently, notwithstanding almost daily examination of the sputum. The pericardial healing has persisted, evidences of an adhesive process being manifest. That such a severe process can result in a cure in the face of an advancing tubercular diathesis is considered most remarkable, and certainly makes surgical measures in such cases seem justifiable.

X. VISCERAL PLEURECTOMY.

Dr. Alexander Hugh Ferguson, of Chicago, after defining visceral pleurectomy (decortication of the lung, or Fowler's operation) to be removed by operation of the thickened visceral pleura in cases of chronic empyema, referred briefly to the work of Fowler (1893), Delormè (1894), Reclus (1894), Gallet (1895), and his own in 1896, as the earliest work done of this kind. He explained the advantages of a partial visceral pleurectomy, clearing out the apex of the lung while the ribs were being removed (Schede), but cautioned against doing too much at one sitting. The indications for the operation were stated somewhat as follows:

1. Suppurating cavity remaining after drainage and various rib resections had been performed.

2. The absence of tubercular foci in the lung that is bound down, or in other parts of the body, lend favor to the procedure being a success; but even these conditions need not deter the surgeon when the patient can withstand the operation. Once the drain on the system caused by the suppuration is stopped, the patient has a better chance to overcome the tuberculous infections wherever they may be.

3. When amyloid disease of the internal organs is beginning to manifest itself, then the operation should no longer be delayed.

4. When it becomes clear that in a certain case the cavity had no further tendency to close, then this operation should be seriously considered.

The pathology, both macroscopic and microscopic, of the visceral pleura removed was very carefully and minutely given. In describing the operation, Dr. Ferguson gave preference to a midaxillary incision, and clearing away all cicatricial tissue, stumps of ribs, etc., in his way to get at the visceral pleura. The offending covering of the lung is boldly cut through to sound lung tissue and cut away en masse if possible. Should the lung have a tendency to bulge out it should be compressed with moist gauze. After cleaning out the apex of the cavity the operation should not be completed if the patient shows signs of weakening, for the major part is now done, and the rest of the thickened pleura may be exsected afterwards under local or gas anæsthesia.

Dr. Ferguson had operated on six cases, and obtained complete success in every instance. In the preparation of cases of chronic empyema for operation, and in carrying out the after treatment, the doctor gave great praise to 33 per cent. of bismuth subnitrate in white vaseline used as a paste to fill all sinuses and cavities as invented and practiced so extensively by Dr. Emil G. Beck, of Chicago. It has been proven that Beck's paste improves all such cases and cures many of them, thus often rendering it unnecessary to do a major operation like visceral pleurectomy.

Dr. Ferguson presented a skiagraph of a case operated on by this method, which showed but a small strip of lung tissue left, a pneumonectomy having been practically performed, and the patient made an excellent recovery.

XI. OPERATIVE TREATMENT OF TUBERCULOSIS OF THE LUNGS.

Professor Dr. P. L. Friedrich, of Marburg, Germany, read a paper with the above title, for which see page 135.

XII. ŒSOPHAGOGASTROSTOMY AFTER INTRATHORACIC RESECTION OF THE ŒSOPHAGUS.

Dr. Willy Meyer, of New York, read a paper with the above title, for which see page 175.

XIII. RESECTION OF THE RIBS COMBINED WITH EXTERNAL PRESSED IN THE TREATMENT OF TUBERCULOSIS OF THE APEX OF THE LUNG.

Dr. Leonard Freeman, of Denver, Colorado, read a paper with the above title, for which see page 145.

XIV. A CONSIDERATION OF SURGICAL PROCEDURES DESIGNED FOR THE RELIEF OF PULMONARY TUBERCULOSIS.

Dr. Charles A. Powers, of Denver, read a paper with the above title, which will be published in a future number of the Annals of Surgery.

XV. EMPYEMA THORACIS.

Dr. Albert Vander Veer, of Albany, New York, read a paper with the above title, for which see page 158.

XVI. THE TREATMENT OF POSTOPERATIVE FISTULÆ AND ABSCESSES FOLLOWING OPERATIONS FOR EMPYEMA.

Dr. Albert J. Ochsner, of Chicago, Illinois, read a paper with the above title, for which see page 151.

XVII. THE OPERATIVE TREATMENT OF HEART WOUNDS.

Dr. Charles H. Peck, of New York, read a paper with the above title, for which see page 100.

The following discussion on thoracic surgery ensued.

Dr. John E. Owens, of Chicago, reported the case of an engineer who was struck in the chest by a piece of molding from the cab of his train in a collision. The piece of molding was 12 feet long. This struck the engineer over the third rib just external to the heart, passed upwards and inwards, coming out at the second rib. He ultimately recovered and returned to work.

Dr. A. G. Gerster, of New York, considered the suggestions of Friedrich very valuable additions to the technic of thoracic surgery. He referred to a recent case of his own, in which the patient, having had a pulmonary tuberculous cavity of the apex suffered a perforation into the pleural cavity. A limited removal of the ribs was done without much effect, and then ten ribs were resected, beginning from the first to the tenth, the approach to the cavity being in the axillary line. The main difficulty was in the resection of the four or five upper ribs. He considers it important to note that in this instance there was no difficulty in removing the first rib. The patient is doing well and an ultimate recovery is looked for.

Dr. John B. Murphy, of Chicago, said that the principles underlying all operations on the thoracic cavity were pulmonary rest and drainage of cavities, to be secured in the early stages by intrathoracic compression with air or gas. If the lung is put at rest cicatrization results and then repair. He also alluded to the pathology of empyema.

Dr. George Tully Vaughan, of Washington, spoke especially with reference to surgery of the heart, stating that in the last year he had had another case recover after suture of the heart. Statistics show that gunshot wounds of the heart give a smaller mortality than stab wounds, which seems rather surprising; also that the highest mortality followed wounds of the right ventricle.

Dr. Richard H. Harte, of Philadelphia, referred to cases of suture of the heart, and said he always had had the greatest difficulty in the introduction of sutures in wounds of the auricle especially.

Dr. Joseph Ransohoff, of Cincinnati, with regard to cases of empyema, said he knew of no class more satisfactorily treated than the acute empyemas in young subjects, which usually heal very promptly and do not become chronic unless allowed to do so before operation. The neglected cases are the ones in which difficulty is encountered. He referred to Fowler's method of removing the pleura from the surface of the lung, which he had followed several times with good results. The subject of the differential pressure apparatus was broached, and the suggestion made that where it was impossible to use this apparatus the lung be grasped as soon as the chest wall is opened, brought into the wound and attached to the wound edges with sutures. He considers a suddenly developed pneumothorax an exceedingly serious thing, often causing death.

Dr. Joseph A. Blake, of New York, spoke with regard to the technic of operations upon the thorax, referring to recent experiments made by Drs. Greene and Janeway. In carrying out the work of the positive pressure apparatus the idea was suggested that the old intralaryngeal method had advantages in that an artificial apnœa could be induced, inhibiting the patient's respiratory movements so that the operator is not embarrassed by the excursions of the diaphragm. They have therefore devised a valve which works rhythmically, increasing the pressure 8 to 10 mm. in the chamber; the patient soon stops breathing of his own volition and the respiratory movements of the chest become more quiet, thus making operation much easier of performance.

DR. SAMUEL ROBINSON, of Boston, referred to some experimental work he had done in the experimental laboratories in Marburg with regard to artificial pneumothorax, and also with regard to the thoraplastic operation; he performed 26 thoraplastic operations upon dogs, with a resulting vastly improved technic.

DR. WILLIAM S. HALSTED, of Baltimore, said that there was reason for hope of cure in cases of aneurism of the abdominal aorta by partial constriction of this vessel, even when the band must be applied above the renal arteries, and cited a case which seemed to prove this assertion. Dr. Halsted has applied an aluminum band to the thoracic aorta about 7 cm. above the diaphragm with the hope of influencing the progress of and relieving the excruciating pain caused by a large aneurism of the upper abdominal aorta, with satisfactory results. He discussed minutely the experimental surgery of the lungs upon dogs, with special reference to the technic, saying that in 21 consecutive thoracotomies there was only one primary infection of the thorax. Positive pressure was employed in all his experiments by means of a very cheap but most effective apparatus devised by Dr. Gatch.

DR. CHARLES A. POWERS, of Denver, said he had been particularly impressed by the work which had been done abroad in cases of surgical interference in pulmonary tuberculosis, especially with reference to nitrogen insufflation in suitable cases. He believes there will be great developments along this line in the near future.

DR. ALBERT VANDER VEER, of Albany, briefly mentioned a paper upon the subject of surgical interference in pulmonary tuberculosis presented by him some years ago. He also referred to a case of recent date in which the thickened pleura was dotted quite extensively with phosphatic deposits, and in which he removed almost completely the entire pleura.

DR. ALEXANDER HUGH FERGUSON, of Chicago, emphasized a simple procedure which he had been using for five or six years, namely, capillary drainage for serous effusion of the lungs and for cases of empyema. He said he had also followed this method of capillary drainage with satisfaction in cases of very large ovarian tumors.

DR. WILLY MEYER, of New York, with regard to empyema spoke in favor of the employment of differential pressure, citing some very interesting cases. With regard to lung extirpation he said he had found that the important point was the proper treatment of the stump of the bronchus, which he treats on the same basis as the appendix stump; his records show that of 18 total left pneumomectomies 15 have recovered, 3 deaths being due to accidental conditions; in 21 operations there were 17 recoveries; in the removal of the lobes in 6 cases there were 5 recoveries. With regard to the œsophagus, he said there was nothing more difficult than the maintenance of asepsis, and he was of the opinion that all methods demanding suture were to be abolished. He believes efforts should be directed to the implantation of the œsophagus into the stomach rather than to bringing it into apposition with the stomach.

XVIII. THE PREVENTION AND TREATMENT OF THE SEQUELS OF PERINEAL PROSTATECTOMY.

Dr. James E. Moore, of Minneapolis, Minn., read a paper on this subject. He said:

Perineal prostatectomy is a life-saving operation, but a grave one, and should not be undertaken lightly. It is accompanied by a mortality rate of a little over 6 per cent. and over 17 per cent. are either complete failures or are followed by some sequel that makes the operation far from satisfactory. Owing to the age and bad condition of these patients mortality rate must be high. The nature of the operation is such that complications and sequels are bound to occur, but at the present time the mortality rate is too high and the sequels too common. According to the latest statistics 7.4 per cent. of these operations are failures, but in competent hands the patient should always experience sufficient relief to justify the operation, though he may not be completely cured. When a patient continues to suffer pain and tenesmus after the operation it is usually due to a pocketed bladder, diseased kidneys or an incomplete operation.

The prostate is an important sexual organ, and its removal by any route or method is sure to have a decided effect on the procreative powers of the patient. Owing to the reticence and untruthfulness of patients it is impossible to state how often this sequel follows, but it is certain that it occurs so frequently that every patient who is comparatively young in years should have this possible contingency stated to him before the operation is performed.

Injury to the rectum is probably the most frequent complication, often causing death, and when a patient survives he is liable to have a urethral rectal fistula. Unskilful use of fingers, downward pulling by retractors and too slight packing with gauze are the usual causes, and by guarding against these causes this accident should be avoided. When the rectum is torn it should be immediately repaired. This will often fail, but succeeds often enough to justify the effort.

Stricture is a more common sequel than is generally believed, and is due to extensive removal of the prostatic urethra. We expect injuries to the urethra from other causes to result in stricture, and there is no reason why it should not follow this operation. Enough of the upper wall of the prostatic urethra should be preserved to secure an unbroken mucous surface extending from the bladder to the meatus. Extensive dissection of the perineum, especially when cross cuts are made, are conducive to stricture. Projecting portions of the urethra are sometimes left which obstruct the flow of urine by acting as valves.

Dribbling or incontinence is an occasional sequel of perineal prostatectomy and is due to injuries to the neck of the bladder and to the compressor urethræ muscles. Instruments introduced into the bladder to draw the prostate down should be used with the utmost care, lest they injure the neck of the bladder. The compressor urethræ is the important sphincter and should be preserved by entering the prostatic rather than the membranous urethra. The treatment of incontinence when once established seems to be hopeless.

Perineal fistula is a rare sequel and is usually due to the deposit of lime salts, the removal of which relieves the condition.

Epididymitis is an occasional sequel, but is usually of little consequence beyond the discomfort it causes, and is very often due to the injudicious passing of sounds.

XIX. SUPRAPUBIC PROSTATECTOMY.

Dr. Arthur Dean Bevan, of Chicago, Illinois, read a paper with this title.

Dr. Albert J. Ochsner, of Chicago, has been much impressed with the greater ease with which the prostate can be enucleated from above. With regard to the question of hemorrhage, he has been able to overcome this by attaching forceps to the capsule, bringing it down, passing in a rubber tube so that the bladder would remain empty, then packing the capsule with gauze for twenty-four hours.

Dr. Alexander H. Ferguson, of Chicago, emphasized the great advantages of the perineal route in operations upon the prostate.

Dr. Joseph Ransohoff, of Cincinnati, while in favor of the suprapubic route, thought there were many points in favor of the perineal. He stated that he frequently did a partial prostatectomy, especially in young patients, which he believes can best be performed by the upper operation.

Dr. Maurice H. Richardson, of Boston, said that he did not believe it was possible, by either the perineal or suprapubic route, for the operator to tell how much damage was being done the urethra. He suits the method of removal to the exigencies of the individual case, and is not a firm adherent to either.

Dr. Stanley Stillman, of San Francisco, referred to the custom of Sir William Macewen, of performing the suprapubic operation in all cases in which the urine could be rendered fairly healthy, but where this could not be done he performed a double lateral lithotomy incision for purposes of drainage, followed by an interval of a week or ten days, during which time granulation tissue lined the incisions which were made, and the capsule of the prostate retracted; in that time the cut surface of the prostate protruded from the wound, the prostate itself was reduced in size, as the result of complete dissection, and ten days later he would shell out with his index finger each lobe of the prostate, with no bleeding and little danger of infection, insomuch as the urine had become fairly healthy in the interval. Dr. Stillman has followed this plan himself for two years with much better results than he ever obtained from other methods of prostatectomy. His preference is distinctly for the suprapubic operation where the urine is healthy, and for Macewen's method where the urine cannot be rendered healthy prior to operation.

Dr. Alexander Primrose, of Toronto, spoke in favor of the suprapubic route, and suggested the possibility of its removal by the transperitoneal route where the urine was healthy.

Dr. John B. Murphy, of Chicago, said he thought there was slight choice between the suprapubic and the perineal route in operating upon the prostate, and that each individual case should be carefully studied and then the method used which would seem to give the best results in that case.

Dr. Leonard Freeman, of Denver, was in favor of the suprapubic operation, having also had difficulties with the perineal. He says that he has been able to control the resulting hemorrhage in suprapubic operations, by firm packing of the wound.

Dr. James E. Moore, who is in favor of the perineal route, said he agreed with Dr. Murphy that the operation should be fitted to the case in hand. With regard to partial excision of the prostate he thought this at times was very good surgery. In answer to Dr. Richardson's query as to how to tell when the urethra was injured, Dr. Moore suggested the examination of the specimen after operation.

Dr. Arthur Dean Bevan, in spite of the statements made by the various men discussing the paper, was still of the opinion that the suprapubic route offered the best results. He commended the suggestion made by Dr. Stillman.

XX. FIBROID TUMORS OF THE UTERUS DEMANDING OPERATION.

Dr. Archibald MacLaren, of St. Paul, Minn., read a paper with the above title, for which see page 287.

Dr. Maurice H. Richardson, of Boston, said he thought there was more danger in a myomectomy than in a hysterectomy, although there was not much danger in either operation. He referred to several of his own cases.

XXI. THE TREATMENT OF TETANUS BY CHLORETONE.

Dr. Willard H. Hutchings, of Detroit, Mich., read a paper with the above title, for which see page 52.

Dr. Theodore A. McGraw, of Detroit, spoke with reference to the first case reported by Dr. Hutchings. In this case Dr. McGraw was most careful to thoroughly disinfect the wound, but in spite of these precautions the tetanus developed.

Dr. John B. Roberts, of Philadelphia, said that he considered the use of chloral, with the addition of the antitetanic serum, in cases of tetanus, very good treatment, but that he was unfamiliar with the composition of chloretone.

Dr. Thomas W. Huntington, of San Francisco, reported three fatal cases of tetanus in which chloral was used to the limit without other effect than producing the peculiar hue of the skin and somnolence during a portion of the period. He considered the report by Dr. Hutchings as a great advance in the treatment of these distressing cases.

Dr. Algernon T. Bristow, of Brooklyn, spoke with reference to the introduction of the antitetanic serum through the spinal cord, believing this to be indicated in cases of tetanus as much as in cases of meningitis. He also spoke highly of Rogers' method of the introduction of the antitoxin. He emphasized the importance of isolating the patient and keeping from him all noise and light.

Dr. De Forest Willard, of Philadelphia, stated that the only case of tetanus he had ever saved had been kept saturated for 28 days with chloral.

Dr. C. B. G. de Nancrède, of Ann Arbor, said he had been able to save a few cases of tetanus by the use of chloral, but had never seen the slightest effect from the antitoxin administered after the disease had started.

Dr. Nathan Jacobson, of Syracuse, said that he did not believe tetanus could be controlled in the least by amputation, citing instances to prove his belief. With regard to the method of introduction of the antitoxin, he found in a study of many cases that the method made little difference in the results. He has never used chloretone, although he has used chloral, which he does not consider particularly effective; he considers that a good deal of confirmatory experience is necessary to warrant the statement that in chloretone there has been found a means of arresting and curing these very acute cases of tetanus.

Dr. John E. Owens, of Chicago, referred to numerous cases of wounds of the hands and feet during the constructive period of the World's Columbian Exposition, in which no tetanus appeared. These wounds were opened rather freely, curetted more or less, then irrigated with 95 per cent. carbolic acid and a surgical dressing applied.

Dr. J. Ewing Mears, of Philadelphia, spoke of the remarkable success in the treatment of tetanus of puerperal origin which had been obtained in the hospital in Ceylon by the use of the antitetanic serum.

Dr. Hutchings said that chloretone was made from equal parts of chloroform and acetone, put in a test-tube, boiled for a minute or two, to which was then added some finely powdered sodium hydroxide. He considered that chloral had proven unsatisfactory. He agreed that the method of injection of the serum made little difference. He considers the isolation of the patient most important. With regard to amputation he considers this has little effect upon the course of the disease.

XXII. TRANSPORTATION OF SKIN-FLAPS FROM ONE PART OF THE BODY TO ANOTHER.

Dr. J. M. F. Finney, of Baltimore, Maryland, read a paper with the above title, for which see page 324.

Dr. John B. Roberts, of Philadelphia, referred to a case in which a hand was grafted to a toe, and then a nose made out of it; also to a case in which the lip was repaired by flaps taken from the belly. In deformities of the chin and face in which the jaw is drawn down and the lip drawn out, he suggested the attaching of flaps down the back and then wrapping them in front of the patient's throat in the manner of a cravat, which method will sometimes allow the chin to be brought up into normal position.

Dr. Samuel J. Mixter, of Boston, referred to the cutting off of the circulation in the flaps by compression with forceps.

Dr. George Tully Vaughan, of Washington, spoke of several cases in which he had successfully employed heteroplasty, and of one unsuccessful case in which he tried to take a piece of skin from the thigh and graft it in the axilla.

Dr. William S. Halsted, of Baltimore, spoke of some experiments in transplanting the muscles in dogs from one dog to another, in which great difficulty was encountered in keeping the dogs bound together in order that the flaps might grow. These experiments had finally to be given up because of the impossibility of keeping the dogs quiet.

Dr. Finney said that the principle of transportation, the term suggested by Dr. Roberts, from one portion of the body to another, is what he wished particularly to emphasize in his paper.

XXIII. SURGERY OF THE LARGE INTESTINE.

Dr. William J. Mayo, of Rochester, Minn., read a paper with the above title, for which see page 200.

Mr. W. Arbuthnot Lane, of London, said that his only criticism of Dr. Mayo's technic was that he considered it much easier to divert the ileum into the sigmoid flexure, as then one could remove as much of the big bowel as desired. He found that if he ran the end of the ileum into the splenic flexure, at the end of some months he had to deal with a dilated ileum.

Dr. J. C. Bloodgood, of Baltimore, spoke with reference to the pathology of carcinoma of the large intestine. Anatomically and pathologically the evidence favors a very extensive resection of the large intestine because the tendency of the new growth is to infiltrate along the wall of the bowel and not into the mesentery with extensive involvement of glands. He suggests instead of the end-to-end anastomosis a large lateral anastomosis with the closed ends of the bowel protruding from the wound; this method has decreased his mortality rate greatly.

Dr. John H. Gibbon, of Philadelphia, referred to 10 cases he had had of resection of the colon for cancer and tuberculosis, one case of which is now well at the end of four years. In this case the colon was resected from the hepatic flexure to the sigmoid. Another case is well eighteen months after resection of the cæcum and ascending colon for cancer. He said that he had frequently made the mistake of doing an immediate resection in case of complete or partial resection where a drainage operation would have been better. The temptation to do the immediate resection and anastomosis is very great in some of these cases, but the operator should never yield to it.

Dr. Samuel J. Mixter, of Boston, suggested another method of anastomosis much like that suggested by Dr. Bloodgood—tying a tube into each open end of the bowel, and then by just a few stitches stitching the bowel together in the position suggested by Dr. Bloodgood, making a sort of double gun-barrel which is brought outside.

Dr. William J. Mayo thought the suggestion of Dr. Bloodgood an extremely good one which he should put into practice. He experimented with end-to-side anastomosis; three cases did well, and then two were lost from leakage. He thinks Dr. Bloodgood's method of bringing the ends of the bowel outside the wound would obviate the leakage.

XXIV. SUDDEN DEATH.

Dr. John Bapst Blake, of Boston, Mass., read a paper upon cases of sudden death occurring during physical exertion or psychic shock, for which see page 43.

Dr. Frederick H. Gerrish, of Portland, Maine, made reference to the first case in which chloroform was to be administered as an anæsthetic. The patient, just before the administration of the chloroform, expired on the table, and he is of the opinion that had any of the drug been given it would have delayed its use as an anæsthetic for many years,—but as was very evident, it could not be blamed for the fatal result in this case.

XXV. ANEURISMS IN YOUNG PEOPLE.

Dr. Theodore A. McGraw, of Detroit, Mich., read a paper with the above title, for which see page 59.

XXVI. RESECTION OF THE SCIATIC NERVE; NEUROPLASTY.

Dr. Kenneth A. J. MacKenzie, of Portland, Oregon, read a paper with the above title, for which see page 295. He also presented the patient whose case was reported and demonstrated the end results of the procedures described.

Dr. Joseph C. Bloodgood, of Baltimore, said that the most interesting part of the case reported was its surgical aspect, as it represents one of the longest resections of the sciatic nerve on record. In his examination of sections of the tumor he was able to find the congenital residue of the multiple tumors now apparent on the patient. He said there is definite proof that many tumors of congenital origin of years' duration, clinically and histologically benign, may at any period become malignant.

Dr. Rudolph Matas, of New Orleans, referred to a case reported by him before the association in 1898 in which there was a huge tumor, even larger than that removed by Dr. MacKenzie. Dr. Matas did not, however, try to restore the sensibility of the parts, as Dr. MacKenzie had done so remarkably. Dr. Matas' patient developed a trophic ulcer of the heel, but after this had healed he was able, with the aid of a brace and a stick, to get along very well.

Dr. MacKenzie said that in trophic changes following injuries to the nerve, where it is impossible to restore motion and sensation, it is still possible, by making a flap operation, to prevent or stop the trophic disturbance.

XXVII. THE OPERATIVE TREATMENT OF FRACTURES.

Dr. John B. Walker, of New York, read a paper with the above title.

Mr. W. Arbuthnot Lane, of London, said he thought there was a certain amount of misunderstanding regarding the overlapping of fragments, stating that he had never seen a case where the shortening could not be completely overcome. He does not consider wire very efficient in the suturing of fragments. He uses strong plates which will stand a strain of 448 pounds, and which are attached by small screws.

Dr. T. W. Huntington, of San Francisco, laid special emphasis upon the value of the X-ray records in dealing with fractures, saying that he kept a complete record of every case, from start to finish.

Dr. Carey, of San Francisco, presented some X-ray plates of cases of fracture showing the perfect reposition obtained by means of the staple, an instrument recommended by Mr. Lane some years ago. His pictures also represented the small amount of callus produced when the fragments are perfectly reduced.

Dr. Charles H. Mayo, of Rochester, Minn., said that in his opinion we should follow the suggestions of those who obtained the best results in the treatment of fractures, rather than continue with the old methods which often proved so unsatisfactory.

XXVIII. OBSERVATIONS ON THE INEQUALITIES OF THE RIGHT AND LEFT FEMORA.

Dr. Algernon T. Bristow, of Brooklyn, New York, read a paper with the above title, for which see page 313.

Dr. T. W. Huntington, of San Francisco, said that he had gone over several cases with regard to the inequalities of the right and left femora. He expressed his appreciation of Dr. Bristow's very carefully prepared paper.

Dr. Albert Vander Veer, of Albany, thought that Dr. Bristow's methods of measurement would be a great help in court in cases of malpractice.

Dr. Frederick P. Gerrish, of Portland, Me., spoke of measurements made thirty years ago of students at Girard College, Philadelphia, by Dr. Martin, who used a very ingenious and accurate apparatus. He arrived at substantially the same results as Dr. Bristow, that there are great variations in the two lower limbs. He also referred to a method of measurement which he used. First, he adjusts the patient as precisely as possible upon a hard mattress or firm bed, having the head held with as nearly as possible perfect adjustment, have the patient take a tape between his front teeth exactly in the middle, and then he measures to the internal malleoli of the right and left side. By this method there is no chance of the shifting of the finger, as when the tape is held on the skin, and he has found it very useful indeed.

Dr. Robert W. Johnson, of Baltimore, said that in the taking of these measurements it was his opinion that the further one got from the pelvis the more likely they were to encounter changes from respiration and from the shifting of gas in the abdominal cavity. The measurements taken from the anterior superior spine would therefore appear to him to offer the best results.

Mr. W. Arbuthnot Lane, of London, referred to a report made by him some twenty-five years ago regarding this subject in bodies at the Guy's Hospital. With all the shortening in these cases he found the spine perfectly straight, which was Nature's compensation. With regard to the use of these measurements in cases of malpractice he could not agree with Dr. Bristow in their accuracy.

Dr. William W. Keen, of Philadelphia, said that he always measured, not from the anterior superior spine to the end of the malleolus, but just the reverse, attaching the fixed end of the tape at the end of the malleolus, but previously by careful manipulation determining what is the centre of the anterior superior spine and marking it. He then stretches the tape from the internal malleolus up to and over, but never touching, the skin over the anterior superior spine, thus reaching a much more accurate measurement than by any other method.

Dr. Richard H. Harte, of Philadelphia, said it was his opinion that no surgeon would rely upon simply one measurement, but would take them by various methods and check them up, thus being sure of the accuracy of his findings.

Dr. Bristow said that he had recently seen several cases in which it was absolutely impossible to bring the limbs together by any amount of weight. He considers the X-ray the best and practically the only method of determining the relative proportions of the two limbs. He emphasizes the fact that the disproportion in the limbs may be erroneously treated by the use of too heavy weights, probably with disastrous results.

XXIX. STRANGULATED RETROPERITONEAL HERNIA.

Dr. William B. Coley, of New York, reported a case of "Strangulated Retroperitoneal Hernia of the Intersigmoid Fossa," for which see page 238, and a case of "Interparietal Ventral Hernia at McBurney's Point," for which see page 246.

XXX. VESICO-INTESTINAL FISTULA.

Drs. F. W. Parham and Joseph Hume, of New Orleans, La., read a paper with the above title, for which see page 251.

XXXI. COMPLETE DETACHMENT OF THE FACIAL BONES FROM THE CRANIUM.

Dr. Charles A. Powers, of Denver, Colo., reported a case of the above character, for the description of which see page 73.

XXXII. MASSIVE KELOID OF FACE AND HANDS.

Dr. Charles A. Porter, of Boston, Mass., reported a case of remarkably massive keloid development, and presented a series of photographs depicting the condition. For this paper see page 332.

XXXIII. THE OLD AND THE BEGINNING OF THE NEW IN SURGERY.

Dr. J. Ewing Mears, of Philadelphia, presented an historical memoir with the above caption, which was read by title. For this memoir see page 23.

XXXIV. SUGGESTIONS FOR THE OPERATIVE CORRECTION OF SYPHILITIC AND OTHER DEFORMITIES OF THE NOSE.

Dr. John B. Roberts, of Philadelphia, presented this paper, which was read by title. It will appear in a future number of the Annals of Surgery.

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ORIGINAL MEMOIRS.

JEJUNAL AND GASTROJEJUNAL ULCER FOLLOWING GASTROJEJUNOSTOMY.

WITH NOTES OF TWO CASES, IN ONE OF WHICH GASTRIC ANALYSES WERE MADE BEFORE AND AFTER OPERATION FOR JEJUNAL ULCER, WITH AN ABSTRACT OF SIXTY-ONE OTHER CASES, AND OBSERVATIONS THEREON.

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NOTWITHSTANDING all that has been written in recent years on the subject of gastrojejunostomy, there remains at least one problem in connection therewith in need of further investigation and elucidation. The fear of the possible occurrence of a jejunal ulcer still casts a shadow, faint it is true, over the otherwise admirable results which follow this operation when performed in appropriate cases. It is of the utmost importance that all instances of this condition should be published, in order that we may have all the available material from which to draw conclusions as to its etiology, as to the best methods of prevention, and of treatment should it occur.

The notes of the following case which has been under my care are of interest, as it is the first case in which an attempt has been made to obtain an accurate analysis of the gastric contents, and of the fluid escaping from a jejunal fistula, before and after operation for ulcer of the jejunum.

Anterior gastrojejunostomy for pyloric stenosis; perforation of a jejunal ulcer five years later; resection of affected portion of jejunum, and anterior gastrojejunostomy "en–Y" (Roux's operation).—H. I., married, aged 47, was admitted into the London Temperance Hospital on August 21, 1902, under the care of my colleague, Dr. Soltau Fenwick, suffering from pain after food, vomiting, and loss of flesh.

History.—Patient has always been healthy until two years ago, when she began to suffer from pain after food, which has gradually increased in severity. Since then she has lost forty-two pounds in weight. For one year she has suffered from vomiting, which has been worse during the past month. She states that the vomiting occurs two or three times a week, large quantities of partially digested food being brought up.

Condition on admission: Patient is very much wasted and weak. Weighs 89 pounds, 4 ounces (normal weight about 133 pounds). Abdomen much distended in upper part. Stomach apparently greatly dilated, lower border reaching a hand's breadth below the umbilicus; constant visible peristalsis; marked succussion splash. At the level of the navel, close to outer border of right rectus muscle, is a hard movable lump about the size of a walnut. Marked free hydrochloric acid reaction in stomach contents after test breakfast, and also in contents of fasting stomach. No lactic acid present.

August 27: Patient has had a good deal of pain since admission, but no vomiting. The stomach has been washed out daily, large quantities of residual food being drawn off. Dr. Fenwick thought that the dilatation of the stomach was due to cicatricial stenosis of the pylorus or duodenum, and asked me to see the patient with a view to operation. The patient declined to have anything done, and left the hospital on August 28. She returned on September 6, looking a good deal worse, and stating that she had been vomiting constantly. She had lost over 4 pounds in weight, and now readily consented to operation.

On September 8 I opened the abdomen in the middle line. The stomach was large and much hypertrophied. In the pyloric region was a dense, hard mass, about the size of a walnut, and situated mainly on the posterior wall. There were no adhesions and the lump was freely movable. Anterior gastrojejunostomy was performed by means of a single row of Halsted's mattress sutures, eighteen sutures in all being employed. The opening between the stomach and jejunum was made two inches long. The pylorus was explored from within, and a hard, almost complete stricture was found. The patient vomited once before leaving the theatre, not afterwards. She made an uninterrupted recovery (highest temperature after operation 98.8° F., highest pulse rate 72), and left the hospital three weeks later.

This was one of my earlier gastrojejunostomies, and I must admit that, at the operation, I thought the pyloric lump to be malignant, and I proposed to reopen the abdomen, remove a portion of the lump for microscopical examination, and if (as I anticipated would be the case) the lump were malignant, perform partial gastrectomy. Clearly, I was wrong in my opinion, but fortunately the patient felt so well that she declined to have any further operation.

I saw the patient again two years later, in August, 1904. She told me that since leaving the hospital she had never had a day's illness or pain of any kind, and that she was able to eat ordinary food. She looked a different being, and weighed 130 pounds, a gain in weight of over three stone. The abdominal wound was soundly healed, and no sign of the pyloric lump could be felt.

On August 13, 1907, the patient was readmitted into the hospital. She stated that ever since the operation in 1902 she had been in excellent health. Two years ago she began to have some pain after food, but the pain was not severe and did not cause her much inconvenience. During the past nine months the pain has increased. Nevertheless she has continued to eat all kinds of food—cheese, tinned foods, etc. For three months the patient has noticed a lump forming in the abdominal wall, above the umbilicus. On August 13, 1907, the lump burst and much yellowish fluid escaped. She was seen by Dr. Edmunds who at once sent her up to the hospital.

Condition on admission: Patient looks well, and is now exceedingly stout, weighing over 168 pounds, a gain of 6 stone since she was last in hospital. Midway between the umbilicus and the ensiform cartilage, immediately to the left of the middle line, is an aperture in the abdominal wall with shelving indurated edges, and from which is escaping a turbid yellowish fluid apparently containing bile. Around the aperture there is considerable induration, and the skin is much thickened for some distance around. Diagnosis, perforated jejunal ulcer.

As the patient was so well nourished I thought that it would be advisable to postpone operation with view to getting the skin into a more healthy condition, and also to reducing the gastric acidity and rendering the intestinal contents sterile by keeping her on an exclusive milk diet. This period of waiting was utilized to make a series of examinations of the gastric contents and the fluid escaping from the fistula.

August 20: Test breakfast (tea and dry toast). One hour later, stomach contents (110 c.c.) drawn off and analyzed: Total acidity 85; total chlorides .433; free HCl .072; protein HCl .208; mineral HCl .153. During the digestion of the test breakfast, and for half an hour afterwards, the fluid escaping from the fistula was collected and analyzed with the following result: Total chlorides .405; free HCl .044; protein HCl .175; mineral HCl .186.

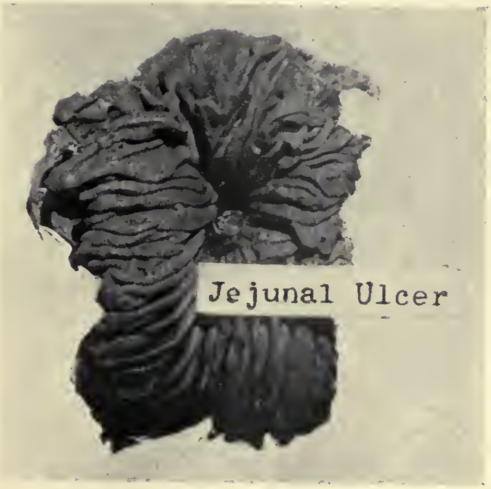
On August 27, after patient had been on a milk diet for a week, another test meal was given. Analysis: Total acidity 80; Gmelin's reaction, absent; total chlorides .361; free HCl .018; protein HCl .187; mineral HCl .146. At the same time 60 c.c. of fluid was collected from the fistula. Analysis: Gmelin's reaction, present; total chlorides .372; free HCl .004; proteid HCl .092; mineral HCl .276.

September 3: 70 c.c. of fluid collected from fistula. Total acidity 60; Gmelin's reaction, present; total chlorides .401; free HCl .004; protein HCl .109; mineral HCl .292.

September 4: Analysis of fluid from fistula. Total acidity 61; Gmelin's reaction, present; total chlorides .324; free HCl .006; protein HCl .113; mineral HCl .204.

September 5: Chloroform. An oval incision was made through the skin around the fistula and carried downwards through the fasciæ and muscles. The peritoneum was cut through in the middle line well below the fistula, and a finger introduced into the peritoneal cavity. The jejunum was found adherent to the abdominal wall for some distance on either side of the fistula. The fistula was plugged with gauze, and the peritoneum was carefully cut through clear of the area adherent to the jejunum. It was then apparent that the fistula led directly into the efferent limb of the jejunum, one inch below the site of the anastomosis with the stomach. Six inches of jejunum including the perforated ulcer and skin attached to it were resected. After sepa-

FIG. 1.



A portion of the jejunum resected in the author's case, showing jejunal ulcer.

rating the jejunum from the stomach, the opening in the stomach measured one inch by half an inch. This opening was enlarged, and the distal end of the jejunum was implanted into it, and the proximal end of the jejunum was implanted into the side of the jejunum four inches below the anastomosis with the stomach. Each anastomosis was performed by means of two continuous sutures. Great difficulty was experienced in suturing the abdominal wound, as after removal of the sinus and dense hard tissue around it there was a considerable interval between the edges of the wound. It is interesting to note that all trace of the pyloric lump felt at the first operation had disappeared.

The patient made an uninterrupted recovery; highest temperature after operation, 99.0; highest pulse rate, 104; bowels well opened after calomel on third morning; stitches removed on the tenth day, wound healed.

On October 12 a test meal was given; 150 c.c. were drawn from stomach. Total acidity 59; Gmelin's reaction, absent; total chlorides .302; free HCl .007; protein HCl .164; mineral HCl .138.

Patient left the hospital on this day in excellent health. Weight 139 pounds.

I did not see the patient again until August 26, 1908. She then told me that she had remained quite well until a month previous, when she began to suffer again from pain in the epigastrium, bearing no relation to food. Two days later the condition of the stomach was investigated. On passing a tube in the early morning, the stomach was found to be empty. After a test meal, 40 c.c. of gastric contents were obtained, containing a good deal of mucus and some blood. No lactic acid present. Total chlorides .430; free HCl .032; protein HCl .317; mineral HCl .080.

In view of the recurrence of hyperacidity and the presence of blood in the stomach I feared the recurrence of ulceration. When she left the hospital after operation of eleven months previous I had advised her never to take meat again, a warning which I found she had disregarded. I again cautioned her as to her diet, and prescribed bismuth and sodium carbonate. The patient so strongly objected to the use of the stomach tube, and was so alarmed at the sight of blood in the gastric contents, that she discontinued attendance for some months, so I lost sight of her again, although I heard indirectly that she was better.

In February, 1909, I persuaded her to come and see me again. She was then much better, although occasionally she suffered from attacks of pain, usually coming on during the night, accompanied by an acid taste in the mouth and not bearing any relation to food. Her weight was 152 pounds; there was no tenderness of the abdomen, the abdominal scar was soundly healed, and she looked in excellent health. Her pain was probably due to hyperacidity, and I could find no evidence of recurrence of ulceration. On bismuth and hydrocyanic acid she quickly improved and lost her pain, and I believe that if she would only be more careful in her diet she would remain well.

In a few of the recorded cases the total acidity was estimated before operation, and in still fewer the amount of free hydrochloric acid as estimated by Töpfer's method is noted. The estimation of free hydrochloric acid by this method, however, is very inaccurate, and the amount of total acidity includes both inorganic and organic acids. The important point, it appears to me, is the amount of free hydrochloric acid present in the gastric contents, and this is very well illustrated in the case I have related. On admission into the hospital for the second time the free hydrochloric acid in the gastric contents was 0.072 per cent., more than three times the normal amount. The amount of free hydrochloric acid in the fluid escaping from the fistula, *i.e.* in the jejunal contents, was 0.044, or more than double the amount normally present in the stomach. This observation appears to me of considerable significance with regard to the etiology of jejunal ulcers. Here we had evidence of the presence of a juice rich in free hydrochloric acid in a portion of the intestine in which the fluid is normally alkaline. That ulceration took place under these conditions is not surprising.

The analysis of the gastric contents after a week on a purely milk diet shows a very different state of affairs. The amount of free hydrochloric acid was then only 0.018 per cent., or just about normal, and the percentage of free hydrochloric acid in the fluid escaping from the fistula had diminished from 0.044 to 0.004. From these analyses we may, I think, draw the following inferences:

1. That the presence of an ulcer in the jejunum was connected with the large percentage of free hydrochloric acid present in the jejunal contents.

2. That as the high percentage of free hydrochloric acid in the gastric contents rapidly diminished to a normal amount on a milk diet, the excess of free hydrochloric acid in this case was probably due to errors in diet.

3. That the bile and pancreatic juices in the jejunum usually neutralize the free hydrochloric acid which escapes from the stomach. When, however, free hydrochloric acid reaches the jejunum in great excess, the alkaline juices are insufficient to neutralize all the free hydrochloric acid present.

Incidentally I may point out that although after a week on a milk diet the amount of free hydrochloric acid had diminished by nearly two-thirds, the total acidity had diminished only from 85 to 80 per cent. This illustrates how little information Töpfer's method gives us as to the amount of inorganic acids present in the gastric contents.

Anterior gastrojejunostomy for pyloric stenosis supposed to be malignant. Recurrence of pain five years later. Seven years later separation of adhesions round jejunum (jejunal ulcer?). Good health until March, 1908. *Death in August,* 1908, *Murphy button still in stomach.*

Anterior gastrojejunostomy by means of a Murphy's button was performed by the late Mr. Walsham on a man aged 69 years suffering from pyloric stenosis which was thought to be malignant. He remained well for nearly five years; then began to suffer constant pain after food. He was sent to see me by Dr. Howard Distin, who thought that the pain was probably due to the irritation of the Murphy button which, so far as was known, had never been passed. His weight was 118 pounds, a gain of three stone since the operation. The stomach was somewhat dilated, and just above the level of the umbilicus there was a rounded induration in the left rectus muscle. Under medical treatment the patient improved, and remained well until the beginning of 1906, when he began to suffer severe pain in the left side with occasional attacks of vomiting.

I saw him again in July. He looked thinner and more careworn than when I had last seen him, and had lost 32 pounds in weight. In the left rectus muscle there was a tender, nodular swelling about the size of a small tangerine orange. A test meal showed the presence of free hydrochloric acid, a trace of lactic acid, and a total acidity of 35. An X-ray photograph showed no trace of the button. After consultation with Dr. Fenwick it was decided to reopen the abdomen in the belief that his symptoms were due to partial closure of the anastomotic opening or to adhesions round the anastomosed loop.

On July 20 I reopened the abdomen. There were adhesions at the pyloric end of the stomach. The pylorus was markedly stenosed, but all trace of the former tumor had disappeared. The anastomosed loop of jejunum was firmly fixed to the anterior abdominal wall for a distance of two inches. There was considerable induration in the jejunal wall, as if there existed, or had existed, an ulcer of the jejunum which had resulted in the adhesion of the jejunum to the abdominal wall. The separation of the adhesions to the abdominal wall would have involved an extensive operation, which I did not think justifiable in view of the patient's age. The other adhesions were divided, and the wound sewn up.

The patient remained quite well until March, 1908, when his appetite began to fail. He suffered no pain, but vomited occasionally. I saw him again in July. The stomach was then considerably dilated; marked stomach splash; no lump to be felt anywhere. It was apparent that the stomach was not emptying itself properly. With occasional lavage he improved for a time, but later his strength gradually failed, and he died in September, 1908, ten years after the gastrojejunostomy. Through the courtesy of Dr. Distin I was able to examine the abdominal viscera.

On opening the abdominal cavity an interesting state of things was found. The stomach was enormously dilated and flabby. High up towards the cardiac end the button could be plainly felt loose in the cavity of the stomach. The anterior stomach wall had been drawn downwards and backwards, so that the site of the anastomosis was posterior rather than anterior. Although an anterior operation with a long loop had been performed, the length of the afferent limb from the ligament of Treitz to the junction with the stomach now measured four inches only, and emerged from under the colon near the splenic flexure. Until a careful examination had been made it was difficult to believe that an anterior and not a posterior operation had been performed. This case bears out a view which I expressed some years ago, that after the anterior operation the afferent limb, although at the time of operation it is drawn up round the colon, becomes later displaced outwards so that it emerges from under the colon at or near the splenic flexure. Nature thus appears to protect the afferent loop from the influence of the excursions of the movable part of the transverse colon.

The stomach was distended with formalin and examined at a later date. When the stomach was opened * I found that the communication between the stomach and jejunum was much contracted and admitted only the tip of the little finger, and was surrounded with a considerable amount of indurated tissue. In the jejunum, just below the anastomotic opening, the mucous membrane was puckered, as if the site of an old ulcer. Microscopical examination showed old chronic inflammation. The pylorus was much stenosed, and indurated, and its lumen was diminished to the size of a cedar pencil.

I have seen in consultation two other probable cases of jejunal ulcer, both in patients on whom the posterior operation had been performed. Details of one of these cases are given among the doubtful cases.†

THE FREQUENCY OF JEJUNAL ULCER.

Jejunal ulcer following gastrojejunostomy is distinctly uncommon. The first case was reported by Braun [1] in 1899. Four years later Brodnitz [2] collected 15 cases, and in 1905 Tiegel [3] collected 22. Gosset [4] in 1906 published an admir-

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* This examination was made too late for the case to be included in my statistics. I have little doubt that at one time there was a jejunal ulcer, but as the existence of an open ulcer was not demonstrated, it is perhaps as well that the case should be included among the "doubtful" cases.

† In one of these cases the diagnosis has since been verified by operation. This patient, who I saw with Dr. Hort and Mr. Cheatle, was subsequently operated on by Mr. Moynihan, who has courteously informed me that he found a duodenal ulcer and two jejunal ulcers.

able article with an abstract of 31 cases. In 1907 Schostak,[5] in an exhaustive dissertation on this subject, summarized 31 cases, and added details of cases previously unreported. Last year Einar Key [6] published a full account of 6 additional cases, one of which is of especial interest, as it is the first reported instance of jejunal ulcer following gastrojejunostomy for gastric carcinoma. In my Hunterian Lectures [7] published in 1906, I related two unpublished instances of jejunal ulcer, and mentioned that jejunal ulcer had occurred in 3 of 295 patients whose after-history I had been able to ascertain. Since that time I have followed up the late history of an additional 53 patients, and in none of these has jejunal ulcer occurred. It is doubtful whether all the cases recorded as instances of jejunal ulcer were really such, as in some of them the diagnosis was a matter of supposition rather than of demonstration. Such cases—and to this class belongs one of the cases I now publish—are not included in my statistics, although I have given brief details of them under the heading of "Doubtful Cases." In this paper I give details of 58 cases already published by other writers, so that including my own cases, and the two I reported in 1906, 52 certain and 10 doubtful cases are now on record, a total of 60 cases.*

The proportion of cases in which gastrojejunostomy is followed by jejunal ulcer is impossible to estimate with accuracy. Mikulicz had 2 cases in 160 gastrojejunostomies. Schostak reports that in the Kronlein Clinic one instance of jejunal ulcer occurred in 92 gastrojejunostomies for non-malignant disease of the stomach. Wickenhauser observed 3 jejunal ulcers in 115 gastrojejunostomies, and Rotgans 1 in 49. As

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* At the German Congress of Surgeons (*Verhandl. der Deutsch. Gesellsch. f. Chir.*, 1906, i, p. 78) Kelling stated that he had observed one instance of jejunal ulcer after gastrojejunostomy "en-Y," and Gosset in his paper mentions a case of Eiselsberg's; but as no details of these cases are available, I have not included them in my paper. Several of the cases have been reported by more than one writer, and if cases of which no details are given are included in statistics, there is a risk that they may be counted twice. If these two cases be included, the number of cases recorded is now 65.

I have already mentioned, jejunal ulcer occurred in 3 of 348 patients whose after-history I traced. Some cases doubtless have not been recorded, and probably more have been unrecognized; but supposing that these equal in number those published, even so the total number would be small in comparison with the enormous number of times the operation of gastrojejunostomy has been performed. Probably more gastrojejunostomies have been performed in America than in any other country, but so far only three cases of jejunal ulcer have been published in American surgical literature. When I visited the United States two years ago, I made inquiries of the many surgeons I had the pleasure of meeting, as to their experience of this complication. Drs. W. J. and C. H. Mayo, who perform some sixty to eighty gastrojejunostomies annually, have yet to observe a case of jejunal ulcer after gastrojejunostomy. Dr. J. B. Murphy has not met with a case, and other leading surgeons testified to a like experience. In the present state of our knowledge, we are, I think, justified in estimating the probable risk of jejunal ulcer following gastrojejunostomy at under 2 per cent.

Clinically the cases of jejunal ulcer hitherto recorded are divisible into two groups:

Group I: Cases in which perforation into the general peritoneal cavity occurs. In this group are 19 cases.

Group II: Cases in which owing to the formation of localizing adhesions, perforation does not result in the escape of bowel contents into the general peritoneal cavity. This group comprises 33 cases, and includes two subdivisions:

(*a*) Cases in which the base of the ulcer becomes adherent to the abdominal parietes, so that perforation results in inflammatory exudation into the abdominal wall (28 cases).

(*b*) Cases in which the base of the ulcer becomes adherent to and perforates into a hollow viscus, the colon in the cases so far recorded (5 cases).

I think it would be well to drop the use of the word "peptic" in connection with jejunal ulcers. It is quite unnecessary, and is misleading, as it implies an hypothesis which as I shall try to show later is incorrect.

As I shall have occasion to point out later, in a considerable proportion of the cases recorded as jejunal ulcer the ulcer was situated at the site of the anastomosis, and therefore was gastric as much as jejunal. I think that ulcers in this situation should be clearly distinguished from jejunal ulcers proper, and I propose so to distinguish them by describing them as gastrojejunal ulcers.

At this point I will give a brief abstract of all the cases so far recorded which I have been able to find.

RECORDED CASES OF JEJUNAL AND GASTROJEJUNAL ULCER AFTER GASTROJEJUNOSTOMY.

Group I.—*Cases in which perforation ensued into the general peritoneal cavity* (19 cases).

1. Braun, "Kongressbericht," 1899, ii, p. 94.—Male, aged 25. Posterior gastrojejunostomy by suture in November, 1897, for pyloric stenosis. Some days after operation vomiting recurred, but gradually ceased again. Symptoms recurred soon after patient left hospital, and early in 1898 patient was readmitted. Stomach was found to be dilated below the umbilicus. Patient improved under treatment. In October, 1898, eleven months after the operation, patient had violent pain in the stomach accompanied by vomiting. Two days later he was admitted into hospital with signs of peritonitis and died the following night.

Postmortem: Peritonitis. Perforated jejunal ulcer in efferent limb, one inch below anastomosis. Anastomotic opening large.

2. Hahn, "Kongressbericht," 1899, p. 74.—Male. Anterior gastrojejunostomy for pyloric stenosis. One year later while lifting a heavy weight, patient was seized with severe pain in the abdomen. Death within twenty-four hours.

Postmortem: Perforated ulcer in efferent jejunal limb, one to two inches below anastomosis.

3. Korte, "Kongressbericht," 1900, p. 137.—Male, aged 30 years. Anterior gastrojejunostomy in February, 1897, for pyloric stenosis. Remained well until March 15, 1900, when he had sudden pain in the abdomen with constipation. On March 20, laparotomy was performed. General peritonitis below the transverse colon, considered to be of appendicular origin. The appendix was removed and the patient died on the following evening.

Postmortem: A subphrenic abscess was found which had ruptured into the general peritoneal cavity. The cause of this abscess was a jejunal ulcer, 7 cm. from the stoma, which had perforated the intestinal wall as far as the serous covering. On the serous surface over the ulcer was a purulent exudation. The original duodenal ulcer was completely healed.

4. Steinthal, "Kongressbericht," 1900, p. 139; *Verhandl. der Deutsch. Gesel. f. Chir.*, 1900, i, p. 139.—Male, aged 44 years. Posterior gastrojejunostomy by means of Murphy's button, for pyloric stenosis. Death ten days later.

Postmortem: Peritonitis due to perforation of jejunal ulcers, two in the afferent and two in the efferent limb of the jejunum. It was thought that the predisposing cause of the perforation was the atheromatous condition of the blood vessels.

5. Goepel, "Kongressbericht," 1902, p. 108.—Anterior gastrojejunostomy was performed on a man suffering from pyloric stenosis. Thirteen months later the patient died from peritonitis.

Postmortem: A perforated ulcer of the jejunum 2 to 3 mm. from the anastomotic opening.

6. Goepel, *loc. cit.*—In this case, the patient—a man—was suddenly seized with abdominal pain and vomiting four months after anterior gastrojejunostomy for pyloric stenosis. The abdomen was opened five hours later, and a perforated jejunal ulcer 2–3 mm. from the anastomotic opening was found and sutured. The patient recovered.

7. Goepel, quoted by Gosset, *Revue de Chirurgie*, 1906, p. 300.—Male, aged 34 years. Anterior gastrojejunostomy was performed, and after nine months of good health a jejunal ulcer perforated. The patient recovered after prompt laparotomy and suture of the ulcer.

8. Mikulicz, quoted by Tiegel, *Mitteil. aus den Grenzebieten der Med. u. Chir.*, xiii, p. 897.—A female infant, aged two months. Anterior gastrojejunostomy with entero-anastomosis for infantile pyloric stenosis. The infant progressed well for two months, but then passed two black motions. The following morning she vomited a large quantity of blood, and died two weeks later.

Postmortem: A perforated ulcer in the ascending limb of the jejunum, and several other ulcers in the jejunum in the neighborhood of the anastomosis.

9. Geo. H. Edington, *Glasgow Medical Journal*, June, 1907,—In September, 1899, anterior gastrojejunostomy for dilated stomach with epigastric pain was performed on a man aged 39 years. He remained well until July, 1904, when he began to suffer from vomiting with severe pain in the right hypochondrium. Cholecystotomy was performed and a stone extracted from the cystic duct. He remained well until November 9, 1906, when he was seized with epigastric pain. On the following day a diagnosis of perforated gastric ulcer was made and the abdomen opened. The abdomen was found to be full of muddy fluid, and a perforation existed on the anterior surface of the jejunum immediately to the left of the anastomotic opening and on the descending limb. The perforation was closed, but the patient never rallied, and died three and a half hours later.

10. Basil Hall (communicated to me by Dr. Basil Hall). A brief abstract was published in "Gastric Surgery," 1906, p. 137.—Gastrojejunostomy by the supracolic route was performed in May, 1901, on a man aged 48 years. This patient was seen at the end of the year 1902,

and was then in excellent health and had put on over three stone in weight. In June, 1903, whilst drunk, he was seized with signs of perforation, and died next day. He was known to be a heavy drinker.

Postmortem: A perforated jejunal ulcer was found six inches below the anastomosis.

11. RUSHTON PARKER. (Notes of this case were kindly sent to me by Mr. Rushton Parker. I gave brief details of the case in "Gastric Surgery," 1906, p. 137.)—Pyloroplasty was performed in December, 1900, on a man aged 51, suffering from pain and vomiting. After a short period of relief the symptoms returned, and a year later anterior gastrojejunostomy was performed. The patient was seen in February, 1904, and was then in excellent health. At 7 A.M. on August 13, 1904, he was moving some object, not a heavy weight, when he had sudden pain and became collapsed. He was seen at 5 P.M. by Mr. Dean of Lancaster, but was then too ill for any operation, and died a few hours later.

Postmortem: Abdominal cavity full of fluid. Intestines adherent with lymph. In the jejunum, opposite to the anastomotic opening, was a perforation the size of a shilling piece. The ulcer was an old one, with thickened edges. The pylorus would hardly admit the tip of a pair of scissors, and was as hard as cartilage.

12. HAMANN, *Cleveland Medical Journal,* May, 1907, p. 183.—Anterior gastrojejunostomy with entero-anastomosis was performed on a man aged 48 years, who had symptoms of gastric ulcer. A Murphy's button was employed for both anastomoses. The smaller button was passed on the eleventh day. The patient progressed well until the twenty-second day after the operation, when he complained of pain in the epigastrium, while an indistinct tender mass was felt in the epigastric and left hypochondriac regions. Death occurred suddenly twenty-six days after the operation.

Postmortem: General peritonitis. The gastro-intestinal union was perfect. On the anterior wall of the efferent limb of the jejunum, just beyond the anastomosis with the stomach, there was a perforated ulcer about one inch in diameter, with a sharply marked border. The button was *in situ,* but it was not considered that this was the cause of the ulcer.

13. BATTLE, *Lancet,* vol. xi, pp. 1246 and 274, 1906, and private communication.—Anterior gastrojejunostomy by means of a Murphy's button was performed in July, 1904, on a man aged 30, suffering from vomiting due to pyloric obstruction. Some months later the abdomen was reopened on account of intestinal obstruction due to the button, which was removed. Twenty-two months after the gastrojejunostomy the patient was readmitted into the hospital with signs of perforation. Four hours after the onset of the symptoms the abdomen was opened, and a small perforated ulcer one-sixth of an inch in diameter found immediately below the anastomotic opening. The surrounding peritoneum was reddened and covered with flakes of lymph. Invagination of the ulcer, with flushing and drainage, was followed by recovery. Mr. Battle has been good enough to inform me that the patient reported himself a month ago (March, 1908) as being in excellent health.

14. Battle, *loc. cit.*—A woman, aged 37, was admitted into St. Thomas's Hospital in March, 1903, with signs of perforation. The abdomen was opened and a perforated ulcer was found on the anterior wall of the stomach near the pylorus. This was sutured and the patient recovered. Later she showed signs of pyloric obstruction, and accordingly an anterior gastrojejunostomy was performed in April, 1904. On May 5, 1905, she was seized with severe pain, and on the following day the abdomen was reopened and a perforated jejunal ulcer was found one and a half inches from the anastomosis. This was sutured and the patient recovered. On March 14, 1905 (1906?), the patient was again admitted, with signs of perforation, and on opening the abdomen a perforation was discovered at the junction of the stomach and jejunum. The perforation was closed by suture and the patient recovered, and is now (March, 1908) in good health.

15. Graser, *Verhand. d. Deut. Gesellschaft f. Chir.*, 1906, i, p. 95.—Posterior gastrojejunostomy by means of a Murphy's button was performed in 1902 by Dr. Dörfler, at Wissenberg, on a woman suffering from a pyloric tumor which was thought to be inoperable carcinoma. About Christmas time in 1905 vomiting recurred. The patient died from hemorrhage and peritonitis in the following May.

Postmortem: An ulcer of the jejunum at the site of the anastomosis was found. In the base of the ulcer was an eroded artery. The anastomotic opening was narrowed so that it admitted only a cedar pencil.

16. Hybrinette, reported by Einar Key, *loc. cit.*—In January, 1899, anterior gastrojejunostomy "en-Y" was performed on a woman aged 45 years, who had a crater-like ulcer adherent to the pancreas, on the posterior wall of the stomach.

March, 1906, patient readmitted. Occasionally she has had severe abdominal pain. During this month pain has been more constantly present and more severe than before. After lavage on March 16 sudden severe abdominal pain. Abdomen distended, diffuse tenderness. The abdomen was reopened. Gas escaped on opening the peritoneal cavity. Flakes of fibrin in neighborhood of old gastrojejunostomy. On the right a considerable amount of turbid exudation free in abdominal cavity. On separating adhesions a perforated ulcer, partly covered by omentum, was discovered at the site of the gastrojejunostomy. The ulcer had constricted the site of the gastrojejunostomy. The edges of the ulcer were excised, and the communication between the stomach and intestine was enlarged. The peritoneal cavity was thoroughly flushed. April 21, the patient was discharged, total acidity 50.

June, 1906: No more vomiting, but suffers from pain in the pit of the stomach, and acid eructations.

17. Lenander, reported by Einar Key, *loc. cit.*—On December 2, 1906, partial gastrectomy and anterior gastrojejunostomy were performed on a woman aged 25 years, suffering from cancer of the stomach. Ten days later the patient died from general peritonitis due to perforating ulcers in the coil of intestine leading to the site of anastomosis.

18. Cackovic, *Liecnicki viestnik*, 1903, vii.—In this case posterior

gastrojejunostomy was performed on a man aged 30 years. Five days after operation the patient died. At the postmortem four perforated ulcers were found in the efferent limb of the jejunum. One of the ulcers was opposite the anastomotic opening, and one 15 cm. below it.

19. Delaloye, *Deut. Zeitschr. f. Chirurg.*, 1906, p. 518.—Anterior gastrojejunostomy was performed in October, 1896, on a man aged 41 years, who had suffered from dyspepsia since the age of 15 years. In the beginning of 1900 the patient was seized with sudden pain in the region of the stomach. Under dietetic treatment he improved, but in June, 1902, he had a second attack and died two days later. A fist-size swelling was felt to the left of the middle line. At the postmortem a perforated ulcer was found at the site of the anastomosis, and round afferent jejunal limb a mass of adhesions adherent to the anterior abdominal wall. It was considered probable that an ulcer existed at the time of the first attack, but that perforation was at that time prevented by the formation of protective adhesions.

Group II (a).—*Cases in which owing to the formation of adhesions general peritonitis did not ensue.*

1. Mikulicz, "Kongressbericht," 1899, p. 74.—Male, aged 32 years. Anterior gastrojejunostomy in September, 1898, for pyloric stenosis. Patient improved for a time, but four months after operation he returned to the hospital with a return of his symptoms. Total acidity of gastric contents, 90–110.

In January, 1899, the abdomen was reopened and a perforated ulcer was found at the anastomotic junction, the ulcer being partly in the stomach and partly in the jejunum. It was adherent to the anterior abdominal wall. The perforation was sutured, and an entero-anastomosis performed.

After a short interval the pain recurred.

In July the abdomen was reopened, and again an ulcer was found in the jejunum at the level of the gastrojejunostomy. Part of the ascending limb of the jejunum was resected, Doyen's operation being performed.

January, 1900, abdomen reopened, and after separating adhesions two nodes were found in the neighborhood of the pylorus, probably indicating ulcers. Jejunostomy by Witzel's method was performed.

In February the patient returned to hospital suffering from severe pain in the sacral and hepatic regions, accompanied by the passing of black stools. Gastric acidity 60 to 72. In March the abdomen was reopened, and the vessels and nerves going to the greater and lesser curvatures were ligatured. In spite of this procedure the pain persisted. Later the patient's condition improved somewhat, but he had to resort to frequent stomach lavage and the use of morphia.

2. Mikulicz, recorded by Tiegel, *Mitt. aus den Grenzeb. der Med. und Chir.*, Bd. xiii, p. 897.—Male, aged 25 years. July 1899, anterior gastrojejunostomy with entero-anastomosis for pyloric stenosis.

October 1: Sudden giddiness, followed by vomiting of several pints of dark material. With a month's rest in bed on a milk diet the patient's condition improved.

January, 1901: Pain again became severe, especially at night. After a test meal, 230 c.c. of fluid were drawn off; total acidity 64; free HCl 53. A few days later the abdomen was reopened. The stomach was found to be fixed to the anterior abdominal wall by adhesions in the region of the gastrojejunostomy. On separating the adhesions a perforated jejunal ulcer was discovered in the ascending jejunal limb. The anastomosis between the stomach and jejunum admitted three fingers, and the entero-anastomotic opening two fingers. After excision of the ulcer, jejunostomy by Witzel's method was performed. Following this operation the patient's condition immediately improved, and he put on weight. After three months the fistula was allowed to close.

In October, 1901, the patient was readmitted into the hospital with well defined and localized pain. Three-quarters of an hour after a test meal, 18 c.c. of fluid were drawn off; total acidity 45; free HCl 32. A third laparotomy was performed. After separation of adhesions an ulcer was found just above the site of the entero-anastomosis. During the next few days the patient vomited much dark material. A week after operation the abdomen was reopened, in the belief that the excision and suture of the ulcer had resulted in obstruction. A new entero-anastomosis was made, and gastrojejunostomy by means of a Murphy's button. This latter proved a very difficult procedure. Ten days later the patient died from peritonitis, the result of perforation of the stomach at the site of the button.

3. Quénu, *Bull. et memoires de la Soc. de Chir. de Paris,* 1902, t. xxviii, p. 250, and also 1904, t. xxx, p. 194.—Male, aged 29 years. July, 1897, anterior gastrojejunostomy by Murphy's button for pyloric stenosis.

Towards the close of the year 1898, the patient began to have sour eructations, and two or three times in the month attacks of vomiting. Occasionally he passed black motions. In June, 1901, for the first time since his operation, the patient again began to suffer pain, in the umbilical region, and having no relation to the ingestion of food. In October, 1901, the patient looked in good health, and did not appear to have lost flesh. In the sheath of the right rectus muscle close to the umbilicus an induration measuring two by three inches was felt. It was tender to palpation.

In January, 1902, the abdomen was reopened. The anastomosis was adherent to the abdominal wall. On separating adhesions a jejunal ulcer was discovered communicating with a cavity in the substance of the right rectus muscle. The gastro-anastomotic opening admitted the thumb and index finger. The anastomosed loop was resected together with the muscle adherent to it. An anterior gastrojejunostomy "en-Y" was then performed. The patient remained well for six months, and then had recurrence of his symptoms. Gastric analysis showed hyperacidity.

In June, 1903, the abdomen was reopened. Many adhesions were present. A jejunostomy "en-Y" was performed.

Mons. le Dr. Quénu has kindly informed me (Feb., 1909) that the patient's pain has disappeared since the last operation, and no further ulceration has occurred. Dr. Quénu thinks that the jejunal opening has served as a safety valve to allow of the escape of some of the acid gastric contents.

4. Kocher, "Kongressbericht," 1902, p. 103.—This patient was a man on whom gastrojejunostomy "en-Y" was performed for pyloric stenosis. After remaining well for three months he again began to suffer pain which was especially severe about two hours after taking food. Later a swelling of the abdominal wall in the region of the left rectus muscle was discovered, and examination of the gastric contents showed a diminution of hydrochloric acid. Kocher thought that at the original operation he had overlooked a carcinomatous growth. One year after the gastrojejunostomy the abdomen was reopened, and a perforated jejunal ulcer was found. This, together with the surrounding indurated tissue, was resected, and the patient made an uninterrupted recovery.

Dr. Albert Kocher has kindly informed me that this patient died some years later from arteriosclerosis. Up to the time of his death he had suffered from no further gastric trouble, and examination showed that his stomach was performing its functions well.

5. Heidenhain, "Kongressbericht," 1902, p. 108, and personal communication.—The patient was a man aged 48, on whom in the year 1898 anterior gastrojejunostomy was performed for pyloric stenosis and a bleeding ulcer. In May, 1899, the patient returned, suffering severe pain. In the left rectus muscle there was a marked induration. On opening the abdomen a perforated jejunal ulcer was found. The perforation was closed and the patient recovered, but some months later his symptoms returned. The abdomen was reopened and a perforated ulcer adherent to the left rectus muscle was found, at the upper margin of the anastomotic opening. The perforation was closed. After this operation the stomach did not appear to be emptying itself well; a new gastrojejunostomy opening was accordingly made. Four years later the patient was reported to be in good health.

Professor Dr. Heidenhain has very courteously given to me the following after-history: For the past seven years the patient has not required to consult a physician. He is perfectly well except for chronic constipation, which he relieves by enemata. He has no gastric pain, no sickness, and very seldom eructations. He takes almost any kind of food. Examination shows that the stomach is large. The patient states that his stomach is always empty in the morning.

6. Kronlein, "Kongressbericht," 1902, p. 110; fuller report by Schostak, *Beitr. f. klin. Chir.*, Bd. lvi, Heft 2, 1907, p. 361.—Anterior gastrojejunostomy was performed in October, 1895, on a man aged 36 years, who had suffered from gastric pain, with hæmatemesis, for eight months. At the operation was found marked induration of the head of the pancreas, probably the result of duodenal ulcer, which had led to pyloric obstruction.

In the spring of 1897 the patient returned with a hard, tender swelling of the abdominal wall, and complaining of severe pain in the left side one to two hours after food. After a time, both swelling and pain disappeared, only to return again in the autumn of the same year.

In July, 1901, there was below the navel on the left side a hard, tender swelling the size of a fist, adherent to the abdominal wall. A diagnosis of peptic jejunal ulcer was made. The abdomen was reopened, and a perforated jejunal ulcer which was adherent to the abdominal wall was sutured.

For a time the patient remained well, but again began to suffer from gastric pain and vomiting. Towards the end of 1902, the gastric pain was especially severe, and he brought up a quantity of blood. He continued at work on and off until July, 1905. In August, 1905, by which time he was reduced to an extreme degree of exhaustion and inanition, the abdomen was reopened. The stomach was greatly dilated, and much adherent especially in the neighborhood of the gastrojejunostomy. The anastomotic opening was completely obliterated. No sign of a peptic ulcer could be discovered. Posterior gastrojejunostomy was performed, entero-anastomosis being made between the afferent limb of the new and the efferent limb of the old gastrojejunostomy.

In December, 1906, the patient remained quite well, and there was no suggestion of a recurrence of his gastric troubles.

7. Czerny, *Beitr. f. klin. Chir.*, Bd. xxxix, p. 98 (supplement).—In the year 1893 Czerny performed posterior gastrojejunostomy on a man aged 59 years, who had pyloric stenosis. He remained well for eight years. Then he began to suffer pain in the gastric region. Marked dilatation of the stomach was present, and hyperacidity, and a resistance in the neighborhood of the umbilicus. Nine years after the first operation the abdomen was reopened, and an ulcer was found at the level of the anastomosis. After separating adhesions the ulcer, together with part of the jejunum, was resected, and a gastrojejunostomy "en-Y" (posterior) was performed. The ascending limb was joined to the descending limb by means of a Murphy's button. The patient died four days later of peritonitis.

8. Czerny, *Beitr. f. klin. Chir.*, Bd. xxxix, p. 99 (supplement).—This patient was a man aged 42 years on whom posterior gastrojejunostomy by means of a Murphy's button was performed for pyloric stenosis in 1900. Six months later his symptoms recurred, and a gastro-enterostomy at the site of the anastomosis was performed. Nine months later he began to suffer from severe attacks of pain. The abdomen was opened anew, and a peptic ulcer was found at the level of the anastomosis adherent to the posterior abdominal wall. The pylorus was much stenosed and was the site of an ulcer. The pylorus with part of the duodenum and of the stomach was excised, and the cut ends united by suture. Six days later the patient died from peritonitis.

9. Neumann, *Deut. Zeit. f. Chir.*, Bd. lviii, p. 270.—March, 1897, anterior gastrojejunostomy was performed on a man aged 24 years, who had suffered from stomach trouble for six years.

In May, 1897, an entero-anastomosis was performed on account of regurgitant vomiting. Some months later the patient began to suffer from colicky pain after food, and a hard, tender swelling formed to the right of the umbilicus.

In May, 1898, the swelling was incised, and a fistula leading into the stomach was found. The fistula was scraped and gradually healed up.

The patient remained well for a time; then the symptoms recurred. In November, 1899, the abdomen was reopened. The jejunum was separated from the stomach. The anastomosed loop was adherent to the abdominal wall, and a perforated jejunal ulcer was discovered. This was resected. He remained well for six months, but in July, 1900, another fistula formed. An ulcer in the region of the anastomosis was found. As the stomach was not dilated, and as the pylorus admitted a finger, the gastrojejunostomy opening was closed. The patient left the hospital in perfect health.

10. MIKULICZ, *Boston Med. and Surg. Jour.*, No. 32, 1903.—In October, 1898, anterior gastrojejunostomy with entero-anastomosis was performed on a man aged 53 years, for pyloric stenosis. The anastomosis was made 28 inches below the duodenum, and the entero-anastomosis 4 inches lower down. The patient returned in January, 1903, stating that he had had four attacks of hæmatemesis, the first in June, 1899, and the last in November, 1902. At this time a tender induration in the right rectus muscle was noticed. There was also hyperacidity and hypersecretion.

In February, 1903, the abdomen was reopened, and after cutting through much indurated vascular tissue, a perforating ulcer, half in the stomach and half in the jejunum, was found. The perforation was sutured transversely by two rows of suture. Six days later the patient died of peritonitis.

11. MIKULICZ, quoted by Tiegel, *loc. cit.*—In January, 1899, anterior gastrojejunostomy with entero-anastomosis was performed on a man aged 33 years, who had suffered from gastric troubles for many years. He remained well for a year and a half, and then had recurrence of his symptoms.

In 1901 a second operation was advised. In reopening the abdomen the stomach, which was adherent to the abdominal wall, was opened; the operation was accordingly not proceeded with further.

In March, 1903, he came under the care of Mikulicz. To the left of the umbilicus was a tender swelling. Three-quarters of an hour after a test breakfast consisting of 400 c.c. of oatmeal soup, 115 c.c. of fluid were drawn off; total acidity 55; free HCl 47. Five hours after a test meal (hashed beef, 125 Gms., some bread and water), 130 c.c. of fluid were drawn off; total acidity 62; free HCl 45.

March 16, 1903, the abdomen was reopened. Extensive adhesions were found, involving both the stomach and intestine. These adhesions surrounded a perforated jejunal ulcer, which was sutured transversely. For six months the patient remained perfectly well. He then began to suffer pain in the neighborhood of the scar, radiating to his back. A tender, hard swelling formed in the region of the cicatrix. The pain bore no relation to food, and after medical treatment gradually diminished and disappeared. During this period, which lasted about six weeks, the patient lost ten pounds in weight. Four hours and a half after a test meal, 230 c.c. of fluid were drawn off; total acidity 42; free HCl 22.

In December, 1903, 128 c.c. of fluid were drawn off from the fasting stomach; total acidity 22; free HCl 9. After a test breakfast, 241 c.c.

were drawn off: total acidity 20; free HCl 10. After a test meal, 240 c.c.; total acidity 75; free HCl 38.

12. SCHLOFFER, *Beitr. z. klin. Chir.*, Bd. xxxii, Heft 2, 1902, p. 357, and private communication.—In July, 1900, anterior gastrojejunostomy was performed on a woman aged 31 years, suffering from pyloric stenosis. Three days later an entero-anastomosis was performed on account of regurgitant vomiting. In October, 1900, the patient was again in the hospital complaining of severe pain in the region of the stomach. To the left of the operation scar was felt a small hard swelling. The abdomen was reopened and a swelling found adherent to the stomach and to the anterior abdominal wall, involving the omentum and hiding the entero-anastomosis from view. As both gastrojejunostomy and entero-anastomotic openings were patent, nothing further was done. In August, 1901, the patient was in excellent health.

Professor Schloffer has kindly furnished me with the following details as to the after-history of this patient. The patient was admitted into hospital for the third time on March 31, 1902. She had again suffered from severe pain in the region of the stomach, and had noticed a very tender swelling in the region of the navel. Examination showed a hard, tender swelling, the size of a fist, in the middle line above the navel, with reddening of the overlying skin. On April 18 the abdomen was reopened. The site of the former gastrojejunostomy was occupied by a large tumor, and the gastrojejunostomy opening was probably obliterated. Accordingly, a new anterior gastrojejunostomy was performed in the portion of stomach between the pylorus and the former gastrojejunostomy. When the patient left the hospital on May 13 the swelling so plainly felt before operation had completely disappeared. The patient was admitted into hospital for the fourth time on November 27, 1902. Since the last operation the patient had suffered occasionally from pain, and sometimes from vomiting, but latterly less frequently. Six weeks before admission she was seized again with severe pain, and accompanied every two to three days by vomiting. No hæmatemesis or melæna. Examination showed a round, hard, tender swelling about the size of an apple, situated on the right side beneath the costal arch. On December 11, 1905, the abdomen was reopened. Stomach not dilated. Pyloric portion of stomach fixed to the tumor mentioned above. A posterior gastrojejunostomy was performed. To this gastrojejunostomy the afferent loop of the first gastrojejunostomy was anastomosed. In March, 1908, the patient was in excellent health.

13. BRODNITZ, "Kongressbericht," 1903, p. 77, and private communication.—Anterior gastrojejunostomy for pyloric stenosis was performed in 1899 on a man aged 58 years. After three years and nine months of perfect health, he began to suffer from severe attacks of pain in the region of the stomach. In the cicatrix was a hard, tender swelling, which in the course of a month increased considerably in size. On opening the abdomen and separating adhesions a jejunal ulcer was discovered. A second ulcer was found at the posterior border of the anastomosis. A portion of the stomach wall, together with part of the ascending and

descending jejunal loops, were resected, and a gastrojejunostomy "en-Y" was performed. On the nineteenth day after operation a fistula formed, from which liquids ingested escaped. The fistula gradually closed up. He remained well for five months, when the pain recurred and a tender infiltration of the left rectus muscle was found. Free hydrochloric acid 1.8 per 1000. Under medical treatment, the pain diminished, and the swelling was no longer tender to palpation.

Dr. Brodnitz has kindly furnished me with the following later details respecting this patient. After several months in perfect health, early in the year 1904 the patient began again to have pain in the stomach region. The infiltration of the left rectus at the navel, which had never disappeared, became markedly tender, the tissues were reddened, and it seemed as if a hernia were forming. A Witzel's jejunostomy was performed. The patient was fed entirely through the fistula, but the pain continued, and the patient vomited quantities of clear acid fluid. After three weeks the patient was again fed by the mouth, and copious doses of magnesia were administered. After three months, the inflammatory effusion which had gradually spread over the whole gastric region, slowly subsided.

At the present time (Jan. 18, 1908) the patient appears blooming, and is able to follow his employment. He can eat anything, but has to take regular doses of magnesia to prevent a feeling of oppression in the stomach. In the left rectus above the level of the navel is a thick painless infiltration, which one not knowing the history of the case would regard as a malignant tumor invading the abdominal wall.

14. Mayo Robson, Trans. Roy. Med. Chir. Soc., vol. lxxxvii, 1904, p. 339.—In January, 1900, anterior gastrojejunostomy was performed on a man aged 44 years, suffering from gastric pain and hemorrhage. The patient remained well for two years, regained his normal weight, and was able to do his work. He then began to have pain in the epigastrium, having no relation to food. At times the pain was very acute. There was marked tenderness in the epigastrium, especially on the left of the middle line. On several occasions there was dark blood in the motions. In May, 1903, there was a well-marked tender swelling in the epigastrium to the right of the middle line. On reopening the abdomen the stomach was found adherent to the abdominal wall, and on separating adhesions a perforated ulcer was found involving the whole circumference of the jejunum at its junction with the stomach. The ulcerated portion of jejunum was resected and a gastrojejunostomy "en-Y" performed.

15. Krause, reported by Jahr, *Berliner klin. Woch.*, 1905, No. 44a, p. 100, and private communication.—In December, 1903, anterior gastrojejunostomy with entero-anastomosis was performed on a man aged 29 years, who had suffered from gastric trouble for five years. In August, 1904, he began to suffer from pain in the left hypochondrium radiating to the back. The pain increased in severity, and he again went into the hospital. At the seat of the pain was a tender flat induration. From the fasting stomach 90 c.c. of fluid was drawn off; total acidity 45; free HCl 25. After a test meal 200 c.c. of stomach contents were drawn off; total acidity 55; free HCl 32. As medical treatment had been of no

avail, the abdomen was re-opened in September, 1905. A perforated jejunal ulcer was discovered opposite to the opening in the stomach and adherent to the anterior abdominal wall. The ulcer was excised and the opening closed with three rows of sutures.

Professor Krause has courteously informed me that this patient was seen and examined on February 8, 1909. "He is in good health. Much food remains in fasting stomach. Free HCl present; no lactic acid. Test meal, 100 c.c., well digested; total acidity 43; free HCl 25."

16. Von Hacker, reported by Hofman, *Beitr. z. klin. Chir.*, Bd. l, 1906, p. 736.—Anterior gastrojejunostomy with entero-anastomosis was performed on a woman aged 22 years. The patient remained well for six years, and then began to suffer from a feeling of oppression to the left of the navel, in which region there was a clearly palpable resistance. Free HCl 0.9 per mille; total acidity 1.8 per mille. Six days later the abdomen was reopened (5–6–05). Many adhesions were separated and a mass of scar tissue excised, revealing a circular peptic jejunal ulcer. This was excised and the opening closed by suture. Ten months later the patient remained in good health.

17. Von Hacker, reported by Hofman, *loc. cit.*, p. 742.—Posterior gastrojejunostomy was performed in June, 1899, on a man aged 45 years, suffering from pyloric stenosis which was considered to be malignant. The patient remained well for one year, and then pain and vomiting recurred, and gradually increased, so that in 1904 a further operation was decided on. Free HCl 1.46 per mille; total acidity 1.84 per mille.

In July, 1904, the abdomen was reopened. At the site of the former gastrojejunostomy was found an ulcer-tumor the size of an egg. A new posterior gastrojejunostomy nearer the pylorus was performed by means of a Murphy's button. One and a half years later the patient remained quite well.

18. Kronlein, reported by Schostak, *Beitr. f. klin. Chir.*, Bd. lvi, Heft 2, 1907, p. 366.—Anterior gastrojejunostomy was performed in March, 1903, by Dr. Aeppli, on a man aged 22 years, suffering from pyloric stenosis. After the operation the patient remained quite well for a year and put on forty pounds in weight. In the course of the year 1904 he again suffered from severe abdominal pain, and he noticed a hard, tender swelling about the size of an egg, to the left of the navel. Under medical treatment he improved for a time. In May, 1905, he was admitted into hospital under Professor Kronlein, who made a diagnosis of peptic jejunal ulcer. The total acidity of the stomach contents was 56.

In June, 1905, the abdomen was reopened. The stomach was greatly dilated, and bound down by adhesions. On separating these an opening was found at the upper part of the anastomosis, involving both the stomach and jejunum. The base of the ulcer was formed by the abdominal wall in the region of the left rectus muscle. The perforation was closed by suture and an omental graft sewn over it. An entero-anastomosis was performed between the afferent and efferent loops of the jejunum. All symptoms disappeared and the patient was quite well and able to work hard in December, 1906.

19. Fritzsche, reported by Schostak, *Beitr. f. klin. Chir.*, Bd. lvi, Heft 2, 1907, p. 368.—A woman aged 18 years, in the autumn of the year 1880 suffered from an attack of inflammation of the cæcum, and from more severe attacks in February and July of the following year. In the year 1897 the patient was admitted into hospital with a tympanitic abscess in the right mesogastrium, on opening which fæces escaped. A fecal fistula resulted. During 1897 and 1898 several unsuccessful attempts were made to close the fistula by suture. In 1899 the abdomen was opened with a view to closing the fistula. A small duodenal fistula was discovered in addition to the cæcal fistula. The operation had to be abandoned on account of adhesions and the friability of the intestine. The patient left the hospital with the fistula smaller, but with constant pain. In September, 1899, the fistulous opening was as big as ever. Anterior gastrojejunostomy was performed in order to divert the gastric contents from the duodenum with a view to a further attempt to close the opening in the duodenum. In February, 1900, there was still a constant flow of intestinal contents from the duodenal fistula; the pylorus was divided and the ends of the stomach and duodenum were closed by suture. In March, 1900, the fistulous opening in the duodenum was closed by suture. In November, 1900, the large fistula in the ascending colon was closed by suture after destruction of the spur by means of a clamp. In the meantime the patient had been suffering from severe pain in the region of the stomach, so severe that morphia was given for its relief. To the left of the navel was a hard induration adherent to the abdominal wall.

In July, 1901, the indurated area of the abdominal wall was excised together with a portion of the jejunum and stomach at the site of anastomosis. The efferent limb of the divided jejunum was implanted in the stomach, and the afferent limb was anastomosed to the efferent (Roux's operation). The patient experienced immediate relief, but shortly after her return home the pain recurred so that she again had recourse to morphia. In Jun, 1902, a fresh peptic ulcer was excised from the site of anastomosis. The opening in the stomach was closed, and the jejunum reimplanted at another spot. The pain disappeared, and the patient returned home; but once again the pain returned, and again she took to morphia. After a time she gradually improved, and two years later was in better health than for many years.

20. Gregory Connell, *Surgery, Gynæcology, and Obstetrics,* January, 1908, p. 39.—Anterior gastrojejunostomy was performed by Dr. Oviatt in 1903 on a patient suffering from gastric ulcer with pyloric stenosis and dilated stomach. The operation was followed by relief for two years, after which there was a gradual return and increase of the stomach symptoms. Three years after the operation Dr. Connell reopened the abdomen and found a cicatricial stenosis of the pylorus with dilatation of the stomach, and practical obliteration of the gastro-intestinal anastomosis. At one end of this cicatricial depression, the end towards the cardia, there was marked induration or thickening of the jejunal wall. This mass was about one-half inch in length, one-quarter inch wide, and

elevated one-eighth of an inch above the surrounding mucosa. It was fibrous in consistency, with its surface white and smooth. It extended through the jejunal wall to the greater curvature of the stomach, to which it was adherent. A second anterior gastrojejunostomy was made with prompt and (thus far, nine months) permanent recovery.

21. Cackovic, *Liecnicki viesnik,* No. 7, and private communication.—Anterior gastrojejunostomy was performed on a man aged 30 years. Eight months after the operation symptoms of ulcer appeared. Five months later the abdomen was reopened, and a perforated ulcer directly opposite the anastomosis was sutured. The patient recovered. The after-history is unknown.

22. Berg, reported by Einar Key, *Nord. Med. Archiv.,* 1907, xl, Afd. 1, Hft. 2.—Anterior gastrojejunostomy (fundosa) was performed in January, 1896, on a man aged 39 years. For a short period after the operation the patient remained quite well, and put on two stone in weight. During the summer of 1896 and during the ensuing winter he suffered from several attacks of sharp cutting pains in the abdomen, which he attributed to indiscretions in diet. Between the attacks he was quite well and able to work. In the summer of 1898 he strained himself lifting a heavy weight, and felt a sharp tearing pain in the region of the umbilicus. In December, 1898, he noticed an abdominal lump to the right of the umbilicus, in which he felt pain after taking food in larger quantity than usual. The pain was immediately followed by vomiting, after which the pain disappeared.

June, 1898, readmitted to hospital. Total acidity 60. Abdomen reopened. Many adhesions between stomach, liver, and neighboring organs. The abdominal lump was the result of adhesions between the gastrojejunostomy and the anterior abdominal wall. In separating these adhesions the intestine was opened. The aperture was closed by three rows of sutures. The patient recovered and for a time his condition remained comparatively good. In the spring of 1902 he became worse, vomiting (3 to 4 quarts) became frequent, and was independent of the nature of food.

Readmitted July, 1902. July 4, abdomen reopened. Many strong adhesions separated and site of gastrojejunostomy exposed. The afferent jejunal loop was greatly hypertrophied, and exhibited strong peristaltic contractions. The efferent limb was small and thin. An entero-anastomosis was performed between the afferent and efferent limbs. He left the hospital somewhat improved on July 26, but subsequent to this date was never really well. Vomiting recurred and necessitated stomach lavage (in 1905 twice daily).

In February, 1905, he was again readmitted. There was an ill-defined tender mass around and to the right of the umbilicus. Total acidity 50. The abdomen was again opened. After separating many adhesions a perforated jejunal ulcer, adherent to the anterior abdominal wall, was discovered 2 to 3 centimeters below the gastrojejunostomy. The portion of intestine involved was resected.

November, 1906. Since the last operation patient has suffered almost daily from colicky pains arising independently of the ingestion of food.

To the right of and below the umbilicus is a tender induration in the right rectus muscle.

23. Berg, operation for jejunal ulcer (gastrojejunostomy previously by another surgeon), reported by Einar Key, *loc. cit.*—Anterior gastrojejunostomy was performed in May, 1895, on a woman aged 38 years, suffering from pyloric stenosis. In the summer of 1895 she suffered from attacks of pain in the right inguinal region. In September the pain became constant and radiated upwards, and she also noticed a lump in left side just below the thoracic margin.

January, 1898: An irregular, hard, tender, fixed swelling felt below the left margin of the thorax, just external to the parasternal line. On inflation stomach found to be 6 cm. below the umbilicus. Operation by Professor Berg, January 23. Stomach adherent to abdominal wall in front of swelling on left side. On separating the adhesions a cavity was found extending about 1 cm. into the abdominal wall, and communicating with the stomach. The stomach could not be freed entirely without widely opening the intestine at the site of the gastrojejunostomy. The portion of jejunum which had been attached to the stomach (about 10 cm. in length) was dissected off and resected. The efferent limb of jejunum was then implanted into the stomach at the site of the previous gastrojejunostomy, and the afferent limb was implanted into the efferent limb lower down (Roux's operation). The part removed from the stomach and abdominal wall presented at its central point a round cavity, about 1 cm. in depth. Lying free in its most dependent part was a coil of intestinal silk suture about 1½ cm. in length, the ends of which entered the walls of the stomach in the direction of the site of the gastrojejunostomy.

The patient remained fairly well until 1900, when she began to suffer again from severe pain, and noticed a swelling in the abdomen. On July 9 the abdomen was reopened. The site of the gastrojejunostomy was adherent to the anterior abdominal wall. On separating the adhesions a cavity was opened which communicated with the stomach and intestine. Here and there in the walls of this cavity were the ends of sutures. The openings into the stomach and intestine were closed by suture and covered with an omental graft. The raw surface on anterior abdominal wall was similarly covered. The patient died on July 23.

Postmortem: Acute peritonitis, perforation of ulcer on the posterior wall of pyloric end of stomach. Several small ulcers existed in the stomach and an ulcer at the site of implantation of the intestine to the stomach.

24. Berg, reported by Einar Key, *loc. cit.*—Anterior gastrojejunostomy was performed in 1899 on a man, aged 26 years, suffering from stenosis of the pylorus and dilatation of the stomach. The patient felt quite well until August, 1903, when, following a movement involving great strain on the abdominal muscles, he again felt diffuse pain and tenderness in the epigastrium. A few days later he became acutely ill with epigastric pain and tenderness below the costal margin to the left of the middle line. After a few weeks he recovered and remained quite well until May, 1904, when, on lifting a heavy weight, pain in the epigastrium recurred. In June, 1904, a resistant mass was felt in the epigastrium to the left of

the middle line. He improved, and the mass could no longer be felt. On returning to work the pain recurred and the swelling was again felt. He was admitted into Professor Berg's clinic in September, 1904. Above the umbilicus and to the left of the middle line a resistant mass was felt which moved with the abdominal wall. Test meal: Total acidity 87; free HCl; bile present. October 10, test meal: Total acidity 29; bile present.

Operation, October 11. The site of the gastrojejunostomy was adherent to the anterior abdominal wall. On separating the dense adhesions, a perforated ulcer was found in the jejunum just below the gastrojejunostomy opening. The opening was sutured, and covered with an omental graft. In January, 1906, the patient was very well, and could digest any food taken in moderation. On a few occasions he had vomited after eating or drinking great quantities.

25. Berg, reported by Einar Key, *loc. cit.*—On September 26, 1905, posterior gastrojejunostomy was performed on a woman, aged 26 years, who had a perforated duodenal ulcer. The ulcer was sutured and the pylorus "excluded." Early in November the pain recurred, and on two occasions was accompanied by cramp in the arms and legs. On November 13 the abdomen was reopened. A peptic jejunal ulcer was found in the afferent jejunal limb 1 to 2 cm. from the gastrojejunostomy. The ulcer was surrounded by a mass of adhesions which had involved and caused a constriction in the efferent jejunal limb. A new gastrojejunostomy was performed (Roux's operation). After the operation the patient continued to vomit daily. On December 3 the total acidity of the vomit was 112. Tetany set in on December 4, and the patient died on the following day.

Postmortem: Just below the gastrojejunostomy opening was an ulcer on posterior wall of the jejunum about the size of a penny. Tuberculosis of some of the mesenteric glands.

26. Rotgans, *Congrès de la Soc. Internat. de Chir.*, Brussel, 1905, p. 170.—This surgeon, at the first Congress of the International Society of Surgeons, mentioned the case of a man from whom he excised a peptic jejunal ulcer following anterior gastrojejunostomy. The patient is reported to have recovered.

27. Cackovic, *Liecnicki viestnik,* 1903, No. 7, and private communication.—Anterior gastrojejunostomy was performed on a man aged 36 years. Two days after the operation the patient vomited blood. Eight days after the operation the vomit became bilious in character, and on the sixteenth day the abdomen was reopened. After separating the adhesions a perforated ulcer on the efferent jejunal limb was discovered and closed by suture, and an entero-anastomosis between the afferent and efferent jejunal limbs was performed. Three months later a fistula formed which under medical treatment gradually healed, so that the patient left the hospital seven months after the original operation. Twenty-two months later a fistula again formed, but healed after three months. The later history of the patient is unknown.

28. Paterson (see full notes at commencement of paper).

Group II (b).—*Cases in which the ulcer became adherent to and perforated into the colon.*

29. Kauffmann, *Mitteilungen aus den Grenziebieten der Medizin und Chir.*, Jena, 1905, Bd. xv, p. 151.—In June, 1901, anterior gastrojejunostomy with entero-anastomosis was performed on a man, aged 41 years, who had suffered from gastric trouble for ten years. The patient gained twenty pounds in weight and remained in good health for three months. Then his symptoms recurred, a feeling of weight and pain some hours after food. In May, 1902, examination showed that the stomach was dilated and marked hyperacidity was present. In April, 1903, severe abdominal pain necessitating the use of morphia. In November, 1903, eructations having an odor of sulphuretted hydrogen, followed a few days later by vomiting of fecal material. A diagnosis of gastrocolic fistula was confirmed by the injection of gentian violet into the rectum. The fluid injected was drawn off from the stomach with a stomach tube.

The patient's condition gradually becoming worse, the abdomen was reopened in March, 1905. The transverse colon was extensively adherent to the stomach and jejunal loop, and there were two fistulous openings—one between the transverse colon and stomach, and the other between the transverse colon and the jejunal loop. After separation of the adhesions the openings were closed by suture. The calibre of the colon was so narrowed by the adhesions and by the suturing that it was deemed advisable to perform an anastomosis between the transverse colon and the sigmoid flexure. This was effected by means of a Murphy's button. Six days later the patient died from perforation of the sigmoid caused by sloughing of the intestine round the button.

At the postmortem it was seen that the fistula between the colon and jejunum was in the efferent jejunal limb. The afferent limb was very short. The gastrojejunostomy opening had become completely obliterated.

30. Czerny, *Beitr. f. Chir.*, Bd. xxxix, p. 99, and private communication.—In November, 1900, Czerny performed posterior gastrojejunostomy by means of a Murphy's button, on a man aged 36 years, suffering from ulcer of the stomach accompanied by dilatation and hyperacidity. The patient remained well until June, 1902, at which time he began to suffer pain. The presence of fecal material in the stomach was noted.

In November, 1902, the abdomen was reopened. On the level of the anastomosis a peptic ulcer was discovered extending towards the anterior stomach wall. The ulcer was adherent to the transverse colon into which it had perforated. The hole in the transverse colon was closed and a new gastrojejunostomy with a Murphy's button was performed at another part of the stomach. Professor Czerny informs me that this patient is well, and working as a gardener.

31. Gosset, *Revue de Chir.*, 1906, vol. xxxiii, p. 59, and private communication.—Posterior gastrojejunostomy was performed in December, 1903, on a man aged 40 years, suffering from the effects of pyloric stenosis. He remained well until July, 1905, gaining fifty pounds in weight. In July, 1905, he slipped and fell in the street, an accident which was immediately followed by a recurrence of pain in the left side. He

began to get thin, and vomiting recurred. The vomit was bilious in character, with a fecal odor. The patient also had persistent diarrhœa, and between July and September lost twenty-two pounds in weight.

At the end of September, 1905, the abdomen was reopened. The efferent jejunal limb was considerably dilated, and four inches below the anastomosis it was adherent to the posterior surface of the transverse colon. On liberating these viscera a large communication was found to exist between the jejunum and transverse colon. The two apertures were closed by suture, and as the transverse colon was somewhat constricted by this procedure, an ileosigmoidostomy was performed. The patient made an uninterrupted recovery. Dr. Gosset informs me that at the present time (April, 1908) this patient is in perfect health.

32. Herczel, Congress of French Surgeons, 1905.—In this case following a posterior gastrojejunostomy performed for pyloric stenosis, a peptic jejunal ulcer formed in the efferent jejunal loop, became adherent to and perforated into the colon, thus producing a jejunocolic fistula.

33. Cackovic, *Liecnicki viestnik,* 1909, No. 5.—Posterior gastrojejunostomy was performed on a man, aged 38 years, who had suffered from gastric trouble since the age of 16. Three years and two months after gastrojejunostomy symptoms of ulcer were noted. No further operation was performed, and the patient died six years after the gastrojejunostomy had been performed. At the postmortem an ulcer of the jejunum was found opposite the anastomosis. The ulcer had perforated through the posterior wall of the colon.

DOUBTFUL CASES.

1a. Fraenkel, *Deut. Archiv. f. klin. Med.,* 1905, Bd. lxxxiv, p. 217.—Anterior gastrojejunostomy with entero-anastomosis was performed, in January, 1904, on a patient whose sex and age are not stated. On December 6 of the same year the patient was seized with sudden pain in the side, and a resistance could be felt to the left of the middle line below the navel. An abscess was opened, and, later, bowel contents flowed from the abscess cavity. By January 10 of the next year the fistula was closed.

2a. Tiegel, *Mitteilungen aus der Grenzebeit. d. Med. und Chir.,* vol. xiii, 1904, 9, p. 909.—In June, 1901, an anterior gastrojejunostomy with entero-anastomosis was performed on a man aged 41 years, who suffered from symptoms of pyloric stenosis. He remained well until August, 1903, when he was seized suddenly with severe pain below the right costal arch. The pain, which was independent of food, came on at intervals of several days or sometimes of weeks. On examination there was a diffuse resistance tender to the least touch; 25 c.c. of liquid without food remains were drawn off from the fasting stomach; total acidity 28; free HCl 12. Three-quarters of an hour after a test breakfast of oatmeal soup, 140 c.c. drawn off; total acidity 49; free HCl 23. Five and a half hours after a test dinner, 130 c.c. drawn off; total acidity 34; free HCl 9. Under treatment the patient improved, and remained well until March, 1904, when the attacks of pain recurred.

3a and 4a. Hahn, quoted by Gosset, *Revue de Chir.*, 1906, t. xxxiii, p. 302.—At the German Congress in 1902 Hahn mentioned two cases in which, after gastrojejunostomy for non-malignant disease, ulcers had perforated and resulted in abscesses of the abdominal wall. Both patients recovered. Further details are not available.

5a. Cackovic, *Liecniki viestnik*, 1903, No. 7, and private communication.—Anterior gastrojejunostomy was performed on a woman aged 40 years. Six days after the operation she suffered from spasmodic pain, and later she had a painful swelling of the anterior abdominal wall. Under antacid treatment for some months the patient recovered, and seventeen months later was "entirely sound" (letter from Dr. Cackovic).

6a. Lyle, *New York Medical Jour.*, 1906, p. 1230.—The abdomen of a man aged 26 years was opened on account of sudden perforation of gastric ulcer near the pylorus. The perforation was closed by suture and posterior gastrojejunostomy with entero-anastomosis was performed. Six months later symptoms of ulcer returned which were relieved by medical treatment.

7a. Schostak, *loc. cit.*—In March, 1901, anterior gastrojejunostomy was performed on a man aged 70 years who had for several years suffered from symptoms of pyloric obstruction. In March, 1902, pain recurred, at first in the region of the liver, so that a suspicion of gall-stones was raised. In July a hard, tender induration was felt to the left of the operation scar, adherent to the abdominal wall. Under medical treatment, he gradually improved and the swelling disappeared. In the autumn of 1902 he still remained well.

8a. Hadra, "Kongressbericht," 1900, s. 152.—Anterior gastrojejunostomy was performed in May, 1899, on a young man suffering from pyloric stenosis. He remained well for six months, and then had recurrence of pain. Between the ensiform cartilage and the navel was an infiltration the size of the hand. Incision of a small blister opened a gastric fistula. The fistula closed but the pain continued. With absolute rest and administration of alkalies the pain disappeared. The case was considered to be one of peptic ulcer.

9a. Paterson, see report on p. 437.

10a. Nyrop, "Ingeskrift f. Talge," 1907, p. 54.—Einar Key mentions a case of supposed jejunal ulcer recorded by Nyrop. I have not been able to consult the original paper, and can therefore give no further details.

The Sex of the Patients.—A striking feature with regard to the recorded cases is the large proportion of male patients. Disregarding the doubtful cases, the sex of the patient is mentioned in 50 of the 52 cases here presented, and of these, 39 were men and only 11 women, a proportion of 78 per cent. of men. The reason for this disparity in the incidence of jejunal ulcer in the two sexes is not clear. Schostak suggests that the men may not pay sufficient regard to the directions given to them as to diet after operation, and that their prediliction for alcohol may act as a predisposing cause. Both these factors may play a part, in one instance the patient was known to be a heavy drinker, and perforation occurred while he was drunk (Group I, Case 10), but they will hardly account for such a marked disproportion. I think that possibly a reason is to be found in the fact that a greater number of men than women are treated surgically for gastric and duodenal ulcers. Dr. W. J. Mayo[9] reports that of his last 100 operations for gastric or duodenal ulcer 62 of the patients were men and 38 females.

The Age of the Patients.—The majority of the patients belong to the middle period of life. The youngest was a female infant aged two months, on whom gastrojejunostomy was performed for infantile pyloric stenosis. The oldest patient was aged 58 years, although among the cases classified as doubtful is that of my patient aged 76 years. The ages of the patients in those cases in which the age is stated are shown in the following tables:

TABLE I.—AGES OF MALE PATIENTS.

	Patients.
20 to 29 years old	8
30 to 39 years old	12
40 to 49 years old	10
50 to 60 years old	4

TABLE II.—AGES OF FEMALE PATIENTS.

	Patients.
Under 20 years old	2
20 to 29 years old	3
30 to 39 years old	3
40 to 50 years old	2

TABLE III.—AGES OF MALE AND FEMALE PATIENTS.

	Patients.
Under 20 years old	2
20 to 29 years old	11
30 to 39 years old	15
40 to 49 years old	12
50 to 60 years old	4
Age not stated	8
	52

Average age: Men, 37.6 years; women, 31.3 years.

The condition for which the original gastrojejunostomy was performed is shown in the following table:

TABLE IV.—CONDITIONS FOR WHICH GASTROJEJUNOSTOMY WAS PERFORMED.

	Cases.
Pyloric stenosis	33
Dilated stomach	2
Gastric ulcer	2
Gastric trouble	6
Duodenal fistula	1
Cancer of stomach	1
Not stated	7
	52

The type of gastrojejunostomy performed is shown in the following table:

TABLE V.—TYPE OF GASTROJEJUNOSTOMY PERFORMED.

	Anterior	Anterior with entero-anastomosis	"en-Y"	Posterior	Supracolic
Group I	11	2	1	4	1
Group II	16	8	1	8	0
Totals	27	10	2	12	1

The Duration of the Interval between Gastrojejunostomy and the Onset of Jejunal and Gastrojejunal Ulcers.—Jejunal ulcer, like gastric ulcer, may run a perfectly symptomless course until the onset of sudden perforation. This was the case in the majority of cases in Group I. In the cases of Group II, it is probable that the ulcer had existed for a considerable time before the onset of symptoms. According to Lenander[10] the reason for this absence of pain in the early stage of these ulcers is that there are no pain-perceiving nerves in the stomach and intestine. Ulceration of these viscera therefore is painless until it invades the peritoneum. We have thus no means of determining the time of onset of ulceration; the nearest we can get is to take the time of the onset of the first symptoms. In the recorded cases the shortest interval was two days (Group I, Case 18), and the longest interval eight years (Group II, Case 7).

The varying periods between the original gastrojejunostomy and the onset of symptoms are shown in the following table:

TABLE VI.—INTERVAL BETWEEN GASTROJEJUNOSTOMY AND ONSET OF SYMPTOMS.

	Cases.
Under 1 month old	5
2 to 3 months old	6
3 to 6 months old	7
6 months to 1 year old	11
1 to 2 years old	8
2 to 3 years old	4
Over 3 years old	8
Interval not stated	3
	52

We see thus that in 56 per cent. of the cases in which data are available, the *symptoms* of ulcer appeared within a year, and in 73 per cent. within two years of gastrojejunostomy. The average of all the cases is twenty months.

The Mortality from Jejunal and Gastrojejunal Ulcer Following Gastrojejunostomy.—The immediate results in the cases of this series are shown in the following tables:

TABLE VII.—MORTALITY OF ALL CASES (GROUPS I AND II).

Recovered	29
Died	22
Result not stated	1
	52

TABLE VIII.—MORTALITY OF UNRECOGNIZED OR UNTREATED CASES (GROUP I).

Recovered	0
Died	13
	13

TABLE IX.—SHOWING MORTALITY IN CASES TREATED BY OPERATION (GROUPS I AND II).

Recovered	29
Recovered after first but died after subsequent operation	2
Died after first operation	6
Result not stated	1
	38

Thus the rate of immediate mortality in all the cases of the series, whether an operation was performed or not, is 42 per cent. Of the cases treated by operation the mortality rate is 15 per cent.; but two of the patients who recovered from a first operation for jejunal ulcer succumbed to a second or subsequent operation. If these two fatalities are included, then the ultimate mortality rate of the operation cases is 21 per cent.

It is noteworthy that the death rate in the cases of Group I treated by operation is identical with the death rate of the cases in Group II (16 per cent.), indeed, if the cases in Group II which proved fatal after a second or subsequent surgical intervention are included, the death rate of the cases in Group II is actually higher than that of the cases in Group I. In other words, the cases in which general peritonitis ensues are less fatal than those cases in which general peritonitis is prevented by the formation of protective adhesions. This is certainly not what at first sight we should expect. Although the cases as yet recorded are too few in number to warrant us in assuming that this is the rule, the higher mortality rate of the cases in Group II is not surprising when we consider that the existence of extensive adhesions, in addition to the occasional necessity of intestinal resection, render operation undertaken in this group of cases a very formidable procedure, as a perusal of the recorded cases will convince those who have had the good fortune not to have had to deal with this complication.

The Influence of the Type of Gastrojejunostomy on the Mortality.—Of the 39 cases in which the anterior type of operation was performed, perforation into the general peritoneal cavity occurred in 14, or 35 per cent., while of the 12 cases in which the posterior operation was performed, perforation ensued in 36 per cent. Whether these figures represent the relative risks of perforation into the general peritoneal cavity in the two groups, it is impossible to say, having regard to small number of cases. It would appear, however, that the mortality after operation in cases in which the posterior operation has been performed is considerably higher than in those in which the anterior has been performed. Including all the cases whether an operation was performed or not, the comparative mortality rate is as follows:

TABLE X.—COMPARATIVE MORTALITY RATE, ALL CASES.

Anterior operation.		Posterior operation.	
Recovered	Died	Recovered	Died
26	13	3	8
Mortality rate 33 per cent.		Mortality rate 72 per cent.	

If, however, we do not take into account those cases in which no operation was performed, 13 in number (1 fatal supracolic operation is not included in these figures) the difference is less, but still very marked:

TABLE XI.—COMPARATIVE MORTALITY RATE, OPERATION CASES.

Anterior operation.		Posterior operation.	
Recovered	Died	Recovered	Died
26	5	3	3
Mortality rate 16 per cent.		Mortality rate 50 per cent.	

This difference is so striking that we can hardly doubt that it is one of cause and effect, and it is what *a priori* we should expect having regard to the different conditions obtaining after the two types of gastrojejunostomy. In jejunal and gastrojejunal ulcer following the anterior operation, the affected portion of intestine is near the surface,—indeed, in 18 of the 25 anterior operation cases in Group II the ulcerated portion of intestine was adherent to the abdominal wall. After the posterior operation, on the other hand, the ulcer is very deeply situated, and adhesions to the omentum and neighboring viscera may render access to it very tedious and difficult.

The Symptomatology of Jejunal and Gastrojejunal Ulcer. The clinical picture presented by the cases in which perforation into the general peritoneal cavity occurs, differs materially from that in cases in which by the formation of protective adhesions general peritonitis is prevented.

Group I. In almost all the cases comprised in this group, the patients had after gastrojejunostomy lost all gastric symptoms, and had been in good health until, suddenly, " like a bolt from the blue," as Schostak graphically puts it, they were seized with sudden severe pain, heralding a perforation peritonitis which in the untreated cases speedily had a fatal termination. In four only of the cases in this group were there any previous indications that the result of the gastrojejunostomy had not been entirely satisfactory. In one case (Case 1 of Group I) the patient had a recurrence of his symptoms soon after leaving the hospital, and on re-admission examination showed that the stomach was dilated below the umbilicus. Under treatment he improved and remained well until the sudden seizure some months later. In another case (Case 8) two weeks before death vomiting and melæna occurred. In Case 15 vomiting recurred five months before death, and in one case (Case 19) there is a history of a sudden attack of pain two years previous to the attack which proved fatal. It is probable that an ulcer existed at the time of the first attack, but that general peritonitis was prevented at that time by the formation of adhesions—a conjecture supported by the discovery at the postmortem of a mass of adhesions round the afferent limb of the jejunum. In one case (Group I, Case 3) peritonitis was the result, not of perforation of an ulcer, but of a subphrenic abscess secondary to a jejunal ulcer, which perforated all the intestinal coats except the serosa. In two instances (Group I, Cases 2 and 11) the seizure followed immediately on the lifting of a weight. Probably in these cases there were slender protective adhesions, the separation of which resulted in the escape of bowel contents. Mr. Battle's case is probably unique, for this patient was operated on for perforation into the general peritoneal cavity on three occasions, once for perforation of a gastric, and twice for perforation of a jejunal ulcer, with a successful result in each occasion.

Group II. Pain varying in intensity, and in many of the cases of a severe character, is the prominent symptom of the cases in this group. In some instances the pain was not sufficiently severe to prevent the patients from following their usual vocations, more or less, for some years before they sought surgical relief, while in others the patients were reduced to an extreme degree of exhaustion. The pain does not appear to have any definite relation to the ingestion of food. In three of the cases (Group II, Cases 3, 11 and 14) this is specifically mentioned. In five instances the pain was aggravated by food, in three cases immediately (Group II, Cases 9, 22 and 28), and in two cases (Group II, Cases 4 and 6) one to two hours later. Vomiting is noted as having occurred in four instances (Group II, Cases 2, 3, 10 and 22). I think that vomiting in these cases may be regarded as evidence of obstruction. Whether the obstruction is antecedent to or consequent on jejunal ulcer is a question which I will discuss further on. In one case (Group II, Case 10) the vomit was chiefly blood, and in one case (Group II, Case 3) there was melæna as well as vomiting.

An important sign of jejunal or gastrojejunal ulcer is the existence of an induration or swelling in the abdominal wall. This condition was noted in 19 of the 28 patients in Group II. The swelling is the result of the adhesion of the ulcerated area to the anterior abdominal wall; perforation of the base of the ulcer leads to an inflammatory exudation into the abdominal wall, and consequent induration, and in some instances to a very definite mass. In one of my own cases (Group II, Case 28) the skin over the swelling became ulcerated and destroyed, so that a jejunal fistula formed. The situation of the swelling is usually in the left rectus muscle about the level of the umbilicus (12 cases). In 4 cases the swelling was in the right rectus, and in 2 in the middle line. In all of these cases the anterior operation had been performed. In the 4 cases of this group in which posterior gastrojejunostomy had been performed, no mention is made of the existence of a swelling, but in one case (Group II, Case 7) it is stated that there was a resistance in the middle line. The fixing of the jejunal loop in front of the colon in the anterior operation, readily explains the frequency of a palpable swelling in these cases. The presence of a swelling in the left rectus then is highly suggestive, if not indeed diagnostic, of gastrojejunal or jejunal ulcer, while the absence of any induration or swelling renders the diagnosis of this condition more difficult and less certain. In the cases in the second division of Group II, signs of a gastrocolic or jejunocolic fistula were present. Thus in Case 29, the patient vomited fecal material; in Case 30 fecal material was found in the stomach on passing a stomach tube, while in Case 31 the patient vomited a bilious material with a fecal odor. In these three patients pain was a prominent symptom. Of Case 32 I have been unable to obtain further details.

The Condition of the Gastric Contents.—For obvious reasons gastric analysis was impossible in the cases belonging to Group I. Even in the cases of Group II the references to the condition of the gastric contents are scanty. From the evidence of the figures given, my impression is that such examinations as were made were done by Töpfer's method, which, as I have already pointed out, is unreliable. My own case appears to be the first case of jejunal ulcer in which any attempt has been made accurately to analyze the gastric contents, and I have to regret that an accurate gastric analysis was not made at the time of the original gastrojejunostomy. Some information as to the gastric contents after gastrojejunostomy is given in 18 of the cases of Group II, and in 5 of them the amount of free hydrochloric acid is stated. Classifying these 18 cases we find:

TABLE XII.—ACIDITY OF THE GASTRIC CONTENTS IN JEJUNAL AND GASTROJEJUNAL ULCER.

	Cases.
High total acidity	9
Normal total acidity with excess of free HCl	4
Normal or subnormal acidity	5
Total	18

From these figures we may conclude that hyperacidity after gastrojejunostomy was present in 13 of the 18 cases in which the gastric acidity was investigated.

The Diagnosis of Jejunal and Gastrojejunal Ulcer.—In the cases in which perforation into the general peritoneal cavity occurs, the signs and symptoms are similar to those of a perforated gastric ulcer. We cannot distinguish between the two conditions, but it appears that after gastrojejunostomy a perforated jejunal ulcer is a more likely event than a perforated gastric ulcer.

The diagnosis of jejunal or gastrojejunal ulcer when protective adhesions are present, must often be uncertain. But this much we can say, that when after an interval of good health a patient who has had gastrojejunostomy performed, begins to suffer constant pain, especially if the pain is accompanied by hyperacidity or hypersecretion, we should bear in mind the possibilty of the existence of a jejunal or gastrojejunal ulcer. When in addition to pain there is an induration or swelling of the abdominal wall in the neighborhood of the stomach, the diagnosis is almost certain. We must remember, however, that a swelling or induration is rarely present in patients on whom the posterior operation has been performed. For practical purposes we may say, that every case of recrudescent pain of a constant character after gastrojejunostomy should be regarded as a case of potential jejunal or gastrojejunal ulcer, and treated accordingly.

The Pathology of Jejunal and Gastrojejunal Ulcer.—In nearly one-third of the recorded cases of jejunal ulcer the ulcer was probably gastric rather than jejunal. By this seeming paradox I mean that under the term jejunal ulcer all writers hitherto have included the cases in which the ulceration is at the site of the anastomosis. Now in these cases it is apparently the gastric mucous membrane that is chiefly involved, and in all probability such ulcers originate in the gastric mucous membrane surrounding the anastomostic opening. I think a distinction should be made between these ulcers and the ulcers which occur in the jejunum. Their characters differ, and I believe the conditions determining their occurrence are dissimilar. For the ulcers at the site of the anastomosis I would suggest the term gastrojejunal. The situation of the ulcers in the cases under consideration is shown in the following table:

TABLE XIII.—SITUATION OF ULCER IN RECORDED CASES.

	Cases.
Jejunal:	
Afferent limb	2
Efferent limb	12
Opposite anastomosis	5
Limb not stated	13
Gastrojejunal (site)	14
Multiple ulcers	6
Total	52

As regards the cases in which there was more than one ulcer. In one case (Group I, Case 4) there were 4 ulcers, 2 in the efferent and 2 in the afferent limb, in one case (Group I, Case 8) there was a perforated ulcer in the afferent limb, and several other ulcers in the neighborhood of the anastomosis. In one case (Group I, Case 17) the ulcers were in the afferent limb. In one case (Group I, Case 18) there were 4 perforated ulcers in the efferent limb, and in two cases (Group II, Cases 13 and 29) there was an ulcer at the site of the anastomosis as well as one in the jejunum.

First, as to the jejunal ulcer proper. This in appearance and clinical course bears a close resemblance to the ordinary round ulcer of the stomach and duodenum. As in the stomach, we have the "punched out" ulcer, suggestive of rapid destruction of tissue, apt to perforate before protective adhesions are formed. Naturally, the thin jejunal wall is more readily destroyed by ulceration than is the gastric wall with its thicker musculature and tough submucous layer. Then, too, we have the jejunal ulcer with shelving, thickened edges, more chronic in course, becoming adherent to neighboring structures, finally perforating and leading to inflammatory infiltration of the adherent structures. Jejunal ulcers are most commonly situated in the efferent limb, either opposite to, or just below the anastomosis, an observation which, as I shall point out later, has a bearing on the etiology of these ulcers.

Secondly, as to gastrojejunal ulcer (ulcer at the site of anastomosis). Gastrojejunal ulcer lacks the definite localized appearance of the jejunal ulcer. It appears as an irregular ulceration round the margin of the anastomotic opening, sometimes involving the jejunal as well as the gastric mucosa. If healing occur, the process of cicatrization may lead to partial (see Group I, Case 15, and Group II, Case 20) or even complete (see Group II, Cases 6 and 29) obliteration of the communication between the stomach and jejunum. To this point I shall refer later. Gastrojejunal ulcers are less likely than jejunal ulcers to perforate into the general peritoneal cavity, for of the 14 recorded cases of gastrojejunal ulcer, perforation into the general peritoneal cavity occurred in 3 (21 per cent.), while of the 36 cases of jejunal ulcer, general peritonitis ensued in 16 (44 per cent.).

The Etiology of Jejunal Ulcer.—Various hypotheses have been adduced as furnishing the explanation of jejunal ulceration following gastrojejunostomy, and although until our knowledge as to the causation of gastric and duodenal ulcers is more precise, conclusions regarding the etiology of jejunal ulcer may require subsequent modification, nevertheless, we can form fairly reliable indications as to the conditions favoring its occurrence, and so come to some conclusions as to the best means of prevention and treatment. The three chief hypotheses which have been put forward to explain the occurrence of jejunal ulcers are as follows:

1. *That Jejunal Ulceration is Due to Circulatory Disturbances in the Attached Jejunum.*—Tiegel[11] suggests that the circulation of the jejunum may be interfered with in several ways:

(*a*) The loop of jejunum which passes in front of the transverse colon may be of insufficient length, and so may be subject to tension, or the blood supply may be impeded by kinks in the mesentery itself.

(*b*) Arteriosclerosis, as in Steinthal's case (Group I, Case 4), in which atheroma was associated with a slight kinking of the mesentery.

(*c*) Injury to the mucous membrane, either at the time of operation or later, by hard particles of food.

A. H. Gould further suggests that circulatory disturbances are more likely to occur when the jejunum is attached by the anterior than by the posterior method.

2. *That Jejunal Ulcer is an Infective Process.*—The hypothesis that jejunal as well as gastric ulcers are of infective origin, has been advocated by Neumann.[12] In support of his view he calls attention to the frequent multiplicity of such ulcers, and with regard to jejunal ulcer he points out its progressive character and its tendency to invade neighboring tissues, and contrasts it with the limited necrosis produced by circulatory disturbance, and he maintains that ulceration presenting this progressive character is invariably of infective origin.

3. *That Jejunal Ulcer is Due to Hyperacidity of the Gastric Contents* (peptic hypothesis).—After gastrojejunostomy the gastric contents escape directly into the jejunum without the previous modification which results, under normal conditions, from their mixture with the alkaline bile and pancreatic secretion in the duodenum. Jejunal ulcer, according to the peptic hypothesis, is due to the digestive action of hyperacid gastric juice on a mucous membrane accustomed only to the presence of alkaline contents.

No single one of these hypotheses affords a satisfactory explanation of all the cases so far observed. The evidence that circulatory disturbances play a part in the causation of jejunal ulcers is very inconclusive. From experience in abdominal surgery we know that the small intestine may form adhesions and may be markedly kinked in places without prejudice to its blood supply. Surely a kink or twist of a degree sufficient to cause interference with the intestinal blood supply would be obvious at a post-mortem examination; but so far in one case only is there any evidence of circulatory disturbance, and in that case the condition found was a slight mesenteric kink and atheroma of the vessels, which may or may not have favored the occurrence of the ulcer which existed. The infective hypothesis affords a probable explanation of those cases (Group I, Cases 4, 8, 12, 17 and 18) in which jejunal ulceration occurred within a very short period of the performance of gastrojejunostomy, and it is significant that in 4 of these 5 cases the ulcers were multiple. In contrast to this we find that in none of the cases in which ulceration occurred at a later period after gastrojejunostomy was there more than one ulcer in the jejunum. This fact, the limited area affected, and the occurrence of spontaneous healing in some instances, are against the general application of the infective hypothesis, and the progressive character of the ulcer in some cases can be explained without supposing an infective origin.

The peptic hypothesis has been adopted by most of those who have written on this subject, so that jejunal ulcer following gastrojejunostomy is usually spoken of as "peptic" jejunal ulcer. This appears to me "putting the cart before the horse," the digestion of the living cells must be a consequence of their injury by the hydrochloric acid of the gastric juice. The peptic action is secondary, the primary factor being the injury of the mucous membrane by the toxic action of hydrochloric acid. And may I again emphasize my belief, that the amount of free hydrochloric acid, not the total acidity of the gastric contents is the important factor. The free hydrochloric acid acts as a poison on the cells of the mucous membrane, so injuring them that they fall a ready prey to digestive action. In a normal individual, probably all the free HCl of the gastric contents is neutralized before the chyme leaves the duodenum. The neutralizing power of the bile and pancreatic juice is well illustrated by the analyses made in the case of my patient. The fluid escaping from the jejunal fistula contained 0.03 per cent. less free HCl than the gastric contents, a difference which shows that the bile and pancreatic juice can more than neutralize all the free HCl present in normal stomach contents. Now after gastrojejunostomy the gastric contents pass directly into the jejunum. Two circumstances, however, prevent this diversion of the gastric contents from exercising an injurious effect on the jejunal mucous membrane. As I have pointed out elsewhere,[13] after gastrojejunostomy there is, first, a distinct diminution of the chlorides secreted by the stomach, and secondly, some regurgitation of bile and pancreatic juice into the stomach. In consequence of these changes, the percentage of free HCl in the gastric contents is markedly diminished, so that after a satisfactory gastrojejunostomy the amount of free HCl entering the jejunum is so small that it is at once neutralized by the bile and pancreatic juice. This view is supported by observations on my patient. When after a period on milk diet the amount of free HCl in the gastric contents had fallen to 0.018 per cent.—a percentage be it said, considerably greater than is usually present after gastrojejunostomy—the fluid collected from the fistula contained merely a trace of free HCl (0.004 per cent.).

As I have already mentioned either hyperacidity or excess of free hydrochloric acid was present in 13 of the 18 cases in which the state of the gastric contents was noted. Hyperacidity therefore is very frequently associated with jejunal ulcer. Is the relation one of cause and effect?

The situation of the ulcers is very significant. In 5 cases only was there an ulcer in the afferent jejunal limb (Group I, Cases 4, 8, 17, and Group II, Cases 2 and 25), and in 3 of these cases the ulcers were multiple (in Cases 4 and 8, ulcers on both afferent and efferent), probably indicating an infective origin. Thus ulceration was limited to the ascending limb in 3 cases only (Group I, Case 17, and Group II, Cases 2 and 25). Of these 3 cases, the first, as I have already indicated, was probably infective; in the second case an entero-anastomosis had been performed, so that the afferent limb was not protected by alkaline bile and pancreatic juice,—while that the third case was infective is suggested by the circumstance that the gastrojejunostomy was performed a few weeks previously for a perforated duodenal ulcer, and that the patient died with tetanic symptoms.

We find then that of the 23 cases in which the exact site of the jejunal ulceration is given, in 20 the ulcer was either opposite the anastomosis, or just below it in the efferent limb,—that is, just where the acidity of the gastric contents when they reach the jejunum is greatest. These facts appear to me to afford strong evidence in favor of the view I am urging, namely, that jejunal ulcer is the result of the toxic action of free hydrochloric acid on the jejunal mucous membrane. In this connection an observation of Kocher's [14] is of considerable interest. On re-opening the abdomen of a patient whose gastrojejunostomy opening did not appear to be acting satisfactorily, he found that the obstruction was not at the gastrojejunostomy opening but immediately below it, in the efferent limb of the jejunum, which was in a state of strong muscular contraction. Kocher is of opinion that the acid gastric juice may stimulate circular contraction of the jejunum just below its junction with the stomach, with the formation of a kind of cul-de-sac in which the stay of the gastric juice may be prolonged and so cause ulceration.

I will at this stage call attention to some other facts which seem to me to warrant the assumption that it is the presence of hydrochloric acid in the jejunum which is the cause of jejunal ulcer. In operating on my own patient I resected a portion of jejunum together with the skin and portion of abdominal wall surrounding the fistula. On examining the specimen I found that the ulcer had completely healed; the margin of the jejunal mucous membrane was continuous with the scar tissue surrounding the fistula without any sign of ulceration. Why had the ulcer, which must have existed for several months at least, healed in less than four weeks? I think that there is only one satisfactory explanation, and this is, that the healing was the consequence of the diminution, as shown by analysis, of the free hydrochloric acid in the jejunum. Whether the diminution was the result of milk diet, or of the rapid escape of intestinal contents which took place through the fistula, is immaterial to the argument. Confirmatory evidence is presented in the records of several other cases. Mikulicz in one of his cases (Group II, Case 2) performed jejunostomy; the patient immediately improved, and three months later the fistula was allowed to close. Shortly afterwards the patient's symptoms returned. Dr. Quénu in his case (Group II, Case 3) resected a portion of jejunum and performed a gastrojejunostomy "en-Y." After a few months the patient had recurrence of his symptoms, and Dr. Quénu then performed a jejunostomy. The patient has remained well ever since (six years), and Dr. Quénu makes the suggestion that the jejunal opening has served as a safety valve to allow of the escape of some of the acid gastric contents. Dr. Brodnitz's patient (Group II, Case 13) was also after a time relieved by a jejunostomy. In one of Dr. Cackovic's patients (Group II, Case 27) a fistula formed, then healed under treatment, and at a later time again formed. Happily the formation of a fistula is Nature's method of getting rid of the excess of hydrochloric acid, and so bringing about a cure. In Dr. Gosset's case (Group II, Case 31), it is interesting to note that the jejunal ulcer perforated into the colon, but at the operation the mucous membrane of the jejunum was continuous with that of the colon without any sign of ulceration. Why did the jejunal ulcer heal? Is not this another instance of the safety valve, the new opening allowing a free escape of the acid juice?

I will now briefly discuss an objection to the view that jejunal ulcer is due to the toxic action of free hydrochloric acid on the jejunal mucous membrane. As I have already pointed out in some of the recorded cases, the acidity of the gastric contents was normal or subnormal. How are we to account for these cases? It appears to me that those who argue that such cases disprove the hyperacidity hypothesis overlook several important points. In the first place, let me point out that although the acidity of the gastric contents may be normal when the patient comes under observation, this does not negative the possibility that at an earlier stage of the disease hyperacidity may have existed. For example, in my own case,—if a gastric analysis had not been made soon after admission, there would have been no evidence of the enormous increase of free hydrochloric acid which existed at that time, as at the time of the second analysis the amount of free hydrochloric acid had fallen slightly below normal. This diminution of acidity under dietetic treatment is also illustrated in Cases 11 and 24, Group II.

In the second place, although the total acidity of the gastric juice may be normal, the amount of gastric juice secreted may be excessive, in other words, hypersecretion may exist without hyperacidity. If there is hypersecretion, although the percentage of free hydrochloric acid in the gastric juice be normal, the quantity entering the jejunum may be such that it is incompletely neutralized by the bile and pancreatic juice. It is significant that hypersecretion was present in two at least of the cases in which the total acidity was normal (Group II, Cases 15 and 22).*

Thirdly, although the acidity of the gastric contents may be normal, the secretion of alkaline pancreatic juice and bile may be deficient, and so the gastric contents may be imperfectly neutralized in the jejunum. This is, of course, a speculation unsupported by any evidence, but it appears to me a reasonable supposition. If this be the case, then any temporary diminution of the flow of bile, or of the secretion of pancreatic juice may favor the occurrence of jejunal ulceration.

Schostak[15] relates a case in which gastrojejunostomy was performed to short circuit the gastric contents, preparatory to closing a duodenal fistula. Subsequently, an operation was necessary on account of a jejunal ulcer (Group II, Case 19). Commenting on this case, he says, that as the patient had no gastric symptoms, it may be concluded that the gastric contents were normal and not hyperacid; and he maintains that the case shows that jejunal ulcer may occur with perfectly normal gastric acidity. In my opinion, no such conclusion is warranted. First, the absence of symptoms is no proof that the stomach contents were normal; secondly, in the absence of an analysis, to assume that the gastric contents were normal is unjustifiable; thirdly, from a perusal of the history it appears quite possible that hyperacidity may have existed. I have found that hyperacidity is a frequent concomitant of appendicitis; this patient had suffered from appendicitis, and so I argue that at least the presumption is, not that the gastric contents were normal, but that they were hyperacid. I do not, however, press this point. I wish merely to indicate that this case cannot be used in argument to support the contention that jejunal ulcer occurs with normal gastric contents.

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* Dr. Cackovic, in a letter received since the above was written, has informed me that in an article published in 1905 (which I have not yet had an opportunity of consulting) he expressed the view, that besides other factors (trauma during operation, arteriosclerosis, etc.) hypersecretion is necessary for the production of ulcer after gastrojejunostomy.

Let us now assume for a moment that jejunal ulcer may in exceptional cases occur without the presence of free hydrochloric acid in the jejunum. An explanation of such cases is not difficult. If we admit, as I think we must admit, that hyperacidity, or rather excess of free hydrochloric acid is present so frequently in cases of jejunal ulcer as to justify the assumption that it is a cause of such ulceration, and if we admit that the hydrochloric acid acts by poisoning or killing the cells of the mucous membrane so that they are digested by the intestinal juices, we have to go only a step further and admit that other substances or toxins may, like hydrochloric acid, act as poisons and injure the living cells of the mucous membrane. Possibly of such an origin are the duodenal ulcers which sometimes accompany cutaneous burns or scalds, and more rarely complicate an attack of appendicitis. That toxic substances may be produced in the stomach we have presumptive evidence in the tetanic attacks which are sometimes associated with pyloric stenosis.

Let me briefly recapitulate the views set forth above: Jejunal ulcer following gastrojejunostomy is the result of a toxic agent or poison which so injures or kills the cells of the jejunal mucous membrane, that they are readily digested by the intestinal juice. The toxic agent usually present is free hydrochloric acid, but possibly other toxic substances may be present, and either may increase the effect of the other. Thus a small percentage of free hydrochloric acid in the jejunum, which by itself would not cause ulceration, may in the presence of some other toxic agent, produce ulceration.

The circumstances under which free hydrochloric acid may be present in the jejunum are: (1) Hyperacidity of the gastric contents, so that the bile and pancreatic juice are unable to neutralize completely all the acid entering the jejunum. (2) Normal percentage of hydrochloric acid in the gastric juice, but excessive secretion, so that the amount of hydrochloric acid discharged into the jejunum is greater than can be neutralized. (3) Diversion of the course of the bile and pancreatic juice, so that part of the jejunum is exposed to the action of the gastric contents unmixed with bile and pancreatic juice, as after operations of the "Y-type," and gastrojejunostomy with entero-anastomosis. (4) Normal acidity and amount of gastric secretion, but incomplete neutralization in the jejunum owing to temporary diminution of the flow of bile, and of the secretion of pancreatic juice.

In a few cases jejunal ulcers are probably of infective origin. Such cases present the following features: (*a*) The ulcers occur within a very short period after gastrojejunostomy. (*b*) The ulcers are usually multiple.

Schematically, the etiology of jejunal ulcer may be represented thus:

SCHEME OF CAUSES OF JEJUNAL ULCER.

1. Hyperacidity; normal flow of bile and pancreatic juice.
2. Normal acidity, but hypersecretion, normal flow of bile, and pancreatic juice.
3. Normal acidity, diminished flow, or diversion of bile, and pancreatic juice.
4. Normal acidity, normal flow of bile, and pancreatic juice. Toxic agent other than HCl.
5. Infective processes.

Since the foregoing part of this paper was written, Dr. Chas. Bolton[16] has published a most instructive and suggestive article, containing a record of observations which appear to me to support the views set forth above. Dr. Bolton found that feeding guinea pigs on solutions of HCl up to 0.7 per cent. produced no effect whatever, but solutions above this strength produced gastric lesions identical in character with those produced by a gastrotoxic serum. He found that the effect of hyperacidity combined with the injection of gastrotoxic serum was a marked increase of the stomach lesions. "It appears," writes Dr. Bolton, "that any strength of HCl above the normal can act as a protoplasmic poison for the gastric cells, and will add its quota to other devitalizing influence and assist in bringing about self-digestion. I think this assistance to produce lesions of poisons which are in themselves innocuous is a very important point. . . . That hyperacidity of the gastric juice increases the lesions produced by gastrotoxin by the HCl acting as a protoplasmic poison, and not by increasing the peptic activity of the gastric juice is rendered probable by the fact that only within small limits will an increase of HCl assist in the digestion of food-stuffs."

I think we may fairly argue that these conclusions as to the action of HCl on the gastric mucous membrane may be applied with even greater force to the action of HCl on the jejunal mucous membrane, which under normal conditions is unused to the presence of acid gastric contents.

So far I have discussed the etiology of jejunal ulcer proper. Much of what has been said applies also to gastrojejunal ulcer. Hyperacidity is an important factor in both, but there is this difference. Jejunal ulcers are a result of altered physiological conditions produced by operation; gastrojejunal ulcers are probably a direct consequence of operation. When a wound becomes ulcerated, the presumption is that the ulceration is a consequence of the wound. Beyond the general rule that jejunal ulcers occur most commonly in that part of the jejunum in which the acidity of the intestinal contents is greatest, we do not know what determines the site and area of ulceration. The site of a gastrojejunal ulcer is determined by the wound made in effecting the anastomosis, and the ulceration persists and spreads if there be hyperacidity of the gastric juice. In 6 of the 14 cases of gastrojejunal ulcer the condition of the gastric contents is noted, and in 5 of these cases there was marked hyperacidity, and in the remaining case there was motor insufficiency and hypersecretion.

In connection with the origin of gastrojejunal ulcer, the question arises, Does primary union take place between the mucous membranes of the stomach and jejunum, when they are maintained in apposition by the use of an inner suture? It is obvious that the necrosis produced by a Murphy's button must result in a ring of ulceration which heals by cicatrization.* Non-apposition of the gastric and jejunal mucous membranes, injury to the mucous membrane during the operation, or infection of the suture used for approximation must also result in healing by granulation. A. H. Gould and Harrington,[17] as the result of experiments on animals, conclude that an inner layer of stitches has little influence upon the healing of the wound. They found that whether the mucous membranes were apposed by suture or not, the mucous membrane round the margin of the anastomosis sloughed, and the separation of the slough left an ulcer which became covered over with mucous membrane in about three weeks. If this be true, then it follows that every gastrojejunostomy is followed by a gastrojejunal ulcer. If hyperacidity or hypersecretion exist, then the ulcer instead of healing may persist or spread, and eventually cause symptoms such as have been described in an earlier part of this paper.

I must, however, state my belief that in human beings primary union of the gastric and jejunal mucous membrane may occur. To attain such a result rigid asepsis is imperative, an impossibility in operations on animals. In human beings, on the other hand, by adequate preparatory treatment, and by careful dieting, it is possible to render sterile the upper part at least of the gastro-intestinal tract, and so to operate under conditions more favorable for primary union than can be obtained in experimental work on animals. I have had an opportunity of examining a considerable number of anastomoses from patients who have died at various intervals after gastrojejunostomy. In all I found direct continuity between the gastric and jejunal mucous membrane, and, further, the thread used for suturing was encapsuled, and had not been discharged into the intestine. In several instances microscopical preparations from recent anastomoses showed continuity of mucous membrane and no evidence of the sloughing which Gould states is the invariable rule. Whether, however, primary union be possible or not, we should employ the means most calculated to obtain it, and of this at least I am convinced, that the use of an inner suture ensures an opening which subsequently contracts less than an anastomosis effected by a button, or by the use of serous sutures only.

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* The process of repair following the use of Murphy's button has been investigated by Barbat, and F. T. Murphy has described the process of healing after anastomosis by means of McGraw's elastic ligature. A. H. Gould, in the work to which I refer later, gives an admirable summary of these researches.

The regurgitation of bile and pancreatic juice which takes place into the stomach after simple gastrojejunostomy, must be favorable to the union of the apposed surfaces by diminishing the acidity of the gastric contents as they pass through the opening, and Nature in her wisdom has so ordered it that this regurgitation is at its maximum just when it is most needed, in the early days after operation. This protective regurgitation is, so far as I have observed, absent in operations of the "Y" type, and when an entero-anastomosis is performed.

Do the clinical histories of the recorded cases support the view that gastrojejunal ulcers are a direct consequence of operation? As I have pointed out already, we have no means of determining the date of the beginning of gastric or intestinal ulceration, and it seems certain that such ulcers may exist for a considerable time without causing symptoms. In view of this knowledge, it is significant that in 9 of the 14 cases of gastrojejunal ulcer, symptoms appeared within a year. In 2 of the cases (Group I, Case 15 and Group II, Case 7) the interval between gastrojejunostomy and symptoms of ulcer was seven and eight years respectively. Any explanation of these late cases must be purely speculative. If it be true that pain is absent until ulceration invades the peritoneum, it is possible that an ulcer commencing as the result of gastrojejunostomy may be so chronic in its course that symptoms do not appear for many years. Another explanation may be suggested.

Gastrojejunostomy may be followed by ulceration round the anastomotic opening; this may gradually heal, and in so doing cause some contraction of the opening. For a time the stomach is able to overcome the partial obstruction at the opening, but later the gastric muscle becomes as it were worn out,—the stomach is no longer able to empty itself completely, and consequently stagnation and hyperacidity supervene. It is noteworthy that in both these very late cases there were marked hyperacidity and dilatation of the stomach.

The Closure of Gastrojejunostomy Openings.—In two of the cases (Group II, Cases 6 and 29) under review there was complete, and in two other cases (Group I, Case 15, and Group II, Case 20) almost complete obliteration of the gastrojejunostomy opening. Schostak [18] makes the suggestion that in most of the reported cases of closure of gastrojejunostomy openings the closure has been due to peptic ulceration. I am not aware that any one has made this suggestion before, and yet it is obvious that closure of the opening must be the result of cicatrization following ulceration. Under what circumstances does this ulceration ensue? The reply to this query is correlated with the answer to another, Why is closure of gastrojejunostomy openings so infrequent nowadays? There must be some change in technic to account for this. I believe the explanation is, that now the necessity for a large opening is becoming recognized, and that now almost all surgeons suture the mucous membrane of the stomach to that of the jejunum whereas formerly they were content with a single layer of serous sutures or used appliances such as Senn's plates or Murphy's button, which by compression cause a localized necrosis, resulting in a granulating surface which subsequently becomes contracted in the process of healing. In my Hunterian Lectures [19] I gave brief details of 19 cases in which obliteration of a gastrojejunostomy opening had occurred, and it is significant that in 17 of them, either Senn's plates, Murphy's button, or a single layer of serous sutures had been employed, all of which methods must lead to the formation of a considerable area of granulating surface. Now, one of two events may happen, either the granulation tissue may become cicatrized in the course of a few weeks, in which the diminution of the size of the opening will not be marked, or, on the other hand, the area of ulceration, instead of healing, may extend, so that if cicatrization subsequently occurs, there will be marked contraction or even obliteration of the anastomotic opening. And just as hyperacidity is the condition which prevents healing of a gastric ulcer, so there can be little doubt that hyperacidity plays the chief rôle in the prevention of the healing of the granulating area round a recent gastrojejunostomy opening.

A few years ago we heard a good deal about the closure of gastrojejunostomy openings in cases of patent pylorus. Indeed, some surgeons went so far as to advocate that when gastrojejunostomy is performed in such cases, the pylorus should be deliberately excluded by suturing—a measure based on erroneous pathology, and little calculated to prevent closure of the anastomotic opening. The train of reasoning was that when the pylorus is patent, the food passes out through the pylorus in preference to the gastrojejunostomy opening, and so the artificial opening, as it is not used, gradually contracts, or becomes completely closed. Now I venture to think that closure of the gastrojejunostomy opening occurs, not because the pylorus is patent, but because the cases in which the pylorus is patent are usually cases of gastric ulcer with marked hyperacidity. The hyperacidity is the causal factor, not the patent pylorus. It is in such cases that gentle handling of the mucous membrane, careful application of sutures, rigid asepsis, and strict dieting after operation are especially important, in order to prevent the occurrence of gastrojejunal ulcer with its attendant risk of subsequent contraction of the opening. I recognize so fully the great impetus which the introduction of Murphy's button gave to intestinal surgery, that I hesitate to say any word which may seem to underrate the merit of this ingenious appliance; nevertheless I venture to think that its use is contra-indicated in cases of patent pylorus, because of the hyperacidity usually existent.

The Influence of the Type of Gastrojejunostomy on the Causation of Jejunal Ulcer.—If jejunal ulcer be the result of the toxic action of hydrochloric acid on the jejunal mucous membrane, it follows that operations of the "Y" type are wrong in principle. After this type of operation the bile and pancreatic juice enter the jejunum some inches below the anastomosis, so that this and several inches of jejunal mucous membrane are exposed to the action of unneutralized gastric contents. Monprofit, one of the few advocates of this operation at the present time, has obtained good results from it. Nevertheless, I think that it is a method which should be employed, if at all, only in those cases in which free hydrochloric acid is absent from the gastric contents. Primary entero-anastomosis, an unnecessary and now seldom performed complication of gastrojejunostomy, is open to the same objection as gastrojejunostomy "en-Y." Inasmuch as the relative frequency with which these methods have been employed is unknown, we cannot prove that they are followed by jejunal or gastrojejunal ulcer more frequently than simple anterior or posterior gastrojejunostomy. But if, as is almost certainly the case, operations of the "Y" type (including entero-anastomosis) have been far less commonly performed than the simple anterior or posterior method, it is perhaps not without significance, that in 24 per cent. of the recorded cases, jejunal or gastrojejunal ulcer has followed gastrojejunostomy "en-Y" or gastrojejunostomy with entero-anastomosis.

A persual of the recorded cases shows that a large proportion have followed the anterior operation, and it has been argued that this method predisposes to jejunal ulceration. At first sight this appears to be the case, but I do not think that a closer examination of the records justifies this assumption. In making a comparison, we should for reasons given above omit those cases in which an entero-anastomosis was performed. If we do this, we find that in 26 instances jejunal or gastrojejunal ulcer followed a simple anterior operation, and in 12 instances a simple posterior operation. There is no doubt that in the present day the posterior operation is far more frequently performed than the anterior, but this was not the case some years back. I think we may fairly state that, at any rate until the year 1901, the anterior operation was the more commonly performed. Now if we divide the recorded cases into two groups, those which occurred after a gastrojejunostomy performed before the year 1901, and those which followed a gastrojejunostomy performed in 1901 or after, we find a marked difference in the proportion of cases following the anterior operation in the two periods, as is shown in the following table:

TABLE XIV.

Gastrojejunostomy before 1901. Ulcer after Ant. op.	Gastrojejunostomy before 1901. Ulcer after Post. op.	Gastrojejunostomy in 1901 or after. Ulcer after Ant. op.	Gastrojejunostomy in 1901 or after. Ulcer after Post. op.
16 cases	6 cases	6 cases	6 cases

It is possible that the upper part of the jejunum is more resistant than the lower to the toxic action of hydrochloric acid, and it is interesting to note that so far no instance of jejunal ulcer after a no-loop gastrojejunostomy has yet been recorded.* Perhaps this immunity of the no-loop operation may be due, not to any difference in the physiology of this method, but to improvements in the technic and treatment of gastric operations in general. I have already alluded to the infrequency of jejunal ulcer in America in the days of both loop and no-loop operations, and my impression is that this is a consequence of the high pitch of perfection to which our transatlantic brethren have brought their operative and aseptic technic. Be this as it may, it is hardly likely that the resisting power of the jejunum at the site of a posterior gastrojejunostomy with a loop, differs so materially from the resisting power at the site of an anterior operation, as to account for the difference in the incidence of jejunal ulcer. The observation that since 1901 the number of cases of jejunal ulcer which have followed the anterior and posterior operations is the same, suggests that the greater frequency of jejunal ulcer following the anterior operation, is simply because in the early days the anterior was the more commonly performed.

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* Moynihan mentions a case in which adhesions round the jejunum were regarded as indicating the existence of a jejunal ulcer. (*Surgery, Gynæcology and Obstetrics,* June, 1907.)

The Causes of Hyperacidity After Gastrojejunostomy.— I have already pointed out that after gastrojejunostomy there is a marked fall in the total acidity of the gastric contents, the result of the altered physiological conditions effected by the operation. This diminution varies from 25 to 40 per cent., and as a rule is sufficient to convert hyperacidity before operation into hypo-acidity after operation. What then are the causes of hyperacidity after operation? We must draw a clear distinction between two classes of cases: (1) Cases in which hyperacidity is present before and *persists* after operation. (2) Cases in which after a period of normal or subnormal acidity following operation, the gastric contents subsequently become hyperacid.

1. Hyperacidity persists after gastrojejunostomy for one of two reasons: (*a*) Extreme hyperacidity before operation. I have estimated the acidity of the gastric contents before and after operation in 56 patients on whom I have performed gastrojejunostomy, and I find that the average diminution of the acidity after operation is 33 per cent. If before operation the total acidity is over 100, then the diminution following operation is sometimes insufficient to reduce the acidity of the gastric contents to normal, unless the patient is kept on a milk diet for some months. (*b*) A too small, inefficient, or defective anastomotic opening. To secure the best physiological results two things are, in my experience, of importance, first, to make a large opening, and secondly, to make the opening towards the pyloric end of the stomach.

2. Hyperacidity of the gastric contents succeeding a period of normal or subnormal acidity is probably due to one of two causes, too small an opening, or indiscretions in diet. In some cases both these factors may be present. When gastrojejunostomy is performed on a dilated stomach, the operations is usually followed by a considerable diminution of the

size of this organ, and so it may happen that an opening originally of good size may become too small owing to the contraction of the stomach around it. Hayem [20] states that the presence of an acid liquid in a fasting stomach is an indication that the opening does not allow of complete evacuation of the stomach. A small or inefficient opening leads to gastric stasis, gastritis and hyperacidity. I quite admit that a slight degree of gastric stasis may have no ill result; but it is reasonable to argue that in such a case a slight attack of gastritis due to some error in diet, insufficient to cause trouble if the anastomotic opening were larger, may lead to such a degree of gastric stasis that hyperacidity ensues. Doubtless in some cases long continued indiscretions in diet may lead to gastritis, however large the opening may be, and in this connection it is interesting to note that one of the fatal cases recorded (Group I, Case 10) is that of a man known to have been a heavy drinker, and the ulcer perforated while he was drunk.

I have observed hyperacidity after gastrojejunostomy in three cases. In one, the hyperacidity before operation was so great that notwithstanding a diminution of nearly 40 per cent., hyperacidity still persisted after operation, but gradually fell below normal as the result of careful dieting. In the second case, in which gastrojejunostomy had been performed some months previously by another surgeon, subsequent operation showed that the opening between the stomach and jejunum was so extremely small that I had to make a new opening, while the third case is the one which I have reported in full at the beginning of this paper. In this case I am of opinion that indiscretions in diet played the chief part in causing hyperacidity; but at the same time I think the opening was of insufficient size,—and it will be noted that in this case (one of my earlier gastrojejunostomies) a single layer of Halsted's sutures was employed, but no inner sutures.

Let us now briefly review the cases to see in what proportion the conditions I have mentioned as favoring jejunal and gastrojejunal ulcer were present. The patients in whom perforation-peritonitis occurred were not in a condition for any elaborate clinical investigation, so our enquiry is limited to the cases of Group II. Details are available in 20 of the cases. Hyperacidity was present in 8 cases, an entero-anastomosis had been performed in 8 cases, and in 5 of these hyperacidity was present in addition, and in one there was hypersecretion. Gastrojejunostomy "en-Y" was performed in one case, in one case there was evidence of obstruction at the anastomotic opening, and in one case in a cavity surrounding the anastomosis a piece of silk was found, which presumably acted as a septic focus. In one case it is stated that the gastric acidity was normal. We see thus that in 19 of the 20 cases in which details are given, one of the conditions mentioned as favoring secondary ulcer was present, and in 6 of these cases, more than one of the conditions referred to was present. These observations put in tabular form are as follows:

TABLE XV.

	Cases.
Hyperacidity present in	8
Entero-anastomosis	2
Entero-anastomosis and hyperacidity	5
Entero-anastomosis and hypersecretion	1
Gastrojejunostomy "en-Y"	1
Septic focus	1
Obstruction at anastomotic opening	1
Normal acidity	1
	20

The Ultimate Results of Operation of Jejunal and Gastrojejunal Ulcer.—The remote results of the surgical treatment of jejunal and gastrojejunal ulcers do not present a pleasing picture. I have been able to ascertain the later history of 25 of the 31 patients who recovered from operation. Of these 25 no fewer than 15 (60 per cent.) relapsed, 2 of whom died later after two or more operations for recurrence of symptoms (Group II, Cases 2 and 23). Seven of the patients who suffered from relapse are known to have been free from further trouble for periods varying from nine months to nine years. Ten only of the patients can be classified as "cured," and even this is perhaps an optimistic conclusion, as in some of these 10 patients, the interval which has elapsed since operation up to the time of the latest report is under one year. Putting the most favorable construction on these figures we see that 60 per cent. of the patients have suffered relapse, 40 per cent. have been apparently "cured" by one operation, and 28 per cent. after two or more operations. These results are shown in the following table:

TABLE XVI.—LATE RESULT OF SURGICAL TREATMENT OF JEJUNAL AND GASTROJEJUNAL ULCER.

		Cases.
"Cured"		10
Relapsed:		
Died after two or more operations	2	
Well after two or more operations	7	
Not cured	3	
Later result unknown	3	15
		25

What can we learn from a study of the different methods of treatment employed in these cases? First, I think they teach us that the simpler the surgical procedure employed, the better the result. Resection of intestine combined with gastrojejunostomy "en-Y" has not been attended with satisfactory results, and the same criticism applies to the cases in which an entero-anastomosis has formed part of the treatment. In just over half of the cases classified as "cured," simple suture only of the ulcer was the method adopted, followed doubtless by a course of careful dieting. Put in tabular form the facts are as follows:

TABLE XVII.—RESULTS OF VARIOUS METHODS OF SURGICAL TREATMENT.

	Cases.
Suture only, 11 cases:	
"Cured"	6
Relapsed	5
New gastrojejunostomy suture, 4 cases:	
"Cured"	3
Relapsed	1
Resection and gastrojejunostomy "en-Y," or suture and entero-anastomosis, 8 cases:	
"Cured"	1
Relapsed	7

Secondly, we learn that those cases, so far as the data available enable us to judge, do best in which at the time of operation for jejunal or gastrojejunal ulcer, hyperacidity does not exist. Hyperacidity or hypersecretion are not favorable to the healing of the extensive wounds left by resections of intestine and gastrojejunostomy "en-Y." In my own case I attribute the comparatively successful result obtained, to the circumstance that before operation the patient was kept on a milk diet until the hyperacidity had markedly diminished. Of the five cases in which relapse occurred after simple suture of the ulcer, untimate success was obtained in one by simple suture of the second ulcer, and in two by the performance of a new gastrojejunostomy. The foregoing facts seem to indicate that part of the surgical treatment of jejunal and gastrojejunal ulcers should consist, either in the enlargement of the original gastrojejunostomy, or in the making of a new one. Whether this should be done at the same time as the suture of the ulcer, I will discuss later.

The Treatment of Jejunal and Gastrojejunal Ulcers.—The treatment of the cases in which perforation into the general peritoneal cavity occurs, is obvious. Immediate laparotomy and suture of the perforation offers the only prospect of saving the life of the patient. If the patient recovers, the condition of the gastric contents should be investigated, and if hyperacidity, hypersecretion, or gastric stasis exist, the gastrojejunostomy opening should be enlarged, or a new gastrojejunostomy performed.

In the cases of Group II in which protective adhesions are present, the indication for surgical treatment is not so clear. The results of operation are not such as to encourage us to resort to surgery until after a trial of medical treatment. Thus in one case (Group II, Case 1) 4 operations, in four cases (Group II, Cases 2, 9, 12 and 22) 3 operations, and in seven cases (Group II, Cases 3, 5, 6, 8, 13, 19 and 23) 2 operations were necessary, and of these 12 patients, two subsequently died, and three were no better after operation than before.

In connection with medical treatment the question arises, What evidence have we of the spontaneous healing of jejunal and gastrojejunal ulcers? We have already seen that obliteration of the gastrojejunostomy opening occurred in two cases (Group II, Cases 6 and 29), and that this obliteration must have been the result of cicatrization following ulceration. It is true that in these cases surgical intervention was subsequently necessary,—nevertheless they show that ulceration at the site of the anastomosis may, under some circumstances, heal spontaneously. In some of the cases in which the presence of ulcer was demonstrated at operation, we have indirect evidence to the same effect. In one case (Group II, Case 11) six months after operation for jejunal ulcer the patient suffered relapse, and a tender, hard swelling formed in the region of the cicatrix. Under medical treatment the patient became quite well, although whether this improvement was permanent or not, I have been unable to ascertain. In another case (Group II, Case 19) after two operations for jejunal ulcer, relapse occurred, but after a time the patient improved, and two years later was in better health than for many years. In my own case relapse with hyperacidity occurred, and the presence of blood in the stomach rendered the existence of ulceration highly probable, but under dietetic and medical treatment the symptoms gradually disappeared.

In this connection a perusal of the cases classified as "doubtful" is of interest, although their value as evidence is somewhat dubious. Thus in Frankel's case (1a) an intestinal fistula formed, probably the result of a jejunal ulcer. Gradual closure of the fistula ensued. In Tiegel's case (2a) two years after gastrojejunostomy with entero-anastomosis, the presence of severe pain and a tender resistance rendered the existence of a jejunal ulcer highly probable. Under treatment the patient improved, but it is important to note that after a few months of good health, the attacks of pain recurred. In Hahn's cases (3a and 4a) the details given are so scanty as to be of little service. In Cackovic's case (5a) the patient suffered from spasmodic pain and a painful swelling of the abdominal wall. After some months' treatment the patient recovered, and Dr. Cackovic has kindly informed me that seventeen months later she was quite well. In Lyle's case (6a) symptoms of ulcer recurred, which were relieved by medical treatment. In Schostak's case (7a) a tender infiltration in the umbilical region, accompanied by pain, gradually disappeared under treatment. In my doubtful case (8a) after separations round a presumed jejunal ulcer the patient remained comparatively well for over two years.

Brodnitz's case (Group II, Case 13) is quoted by Schostak as an instance of cure under medical treatment; but the further details with which Dr. Brodnitz has kindly furnished me, show that the patient subsequently required further operative treatment. I have pointed out already that examination of the specimen from my own case showed that the jejunal ulcer had healed before I operated, and in another case (Group II, Case 31) the fistula between the jejunum and colon was lined with mucous membrane which showed no trace of ulceration. Although in both these cases the ulcer healed, they can hardly be regarded as instances of cure without operation, as in both surgical interference was imperative.

The evidence therefore as to the possibility of permanent relief by medical treatment is very inconclusive. In two only of the cases so treated is the later history known, and in one of these (Group II, Case 13) relapse subsequently ensued. All we can say for certain is, that occasionally jejunal and gastrojejunal ulcers heal, but the process of healing is apt to result in a condition requiring surgical intervention.

MEDICAL TREATMENT.

Notwithstanding the conclusions formed from a study of the cases, I think that before an operation is performed the patient should undergo a course of careful dietetic and medical treatment, for two reasons,—First, there is just a possibility, remote it is true, that in this way a cure may be brought about, and, Secondly, if subsequently operation be necessary, success will be more likely to follow if as the result of medical treatment the acidity of the gastric contents is diminished.

The patient should be kept at absolute rest in bed, and on a diet of milk and eggs, as recommended by Lenhartz for the treatment of gastric ulcer. Bismuth combined with small doses of hydrocyanic acid usually relieve the pain, and the researches of Pawlow [21] appear to me to show conclusively the value of the administration of alkalies in diminishing the acidity of the gastric contents. The effect of diet in reducing the acidity of the gastric contents is well illustrated in my own case, as well as in the cases (Group II, Cases 11 and 24) reported by Mikulicz and Einar Key. If under medical treatment the pain disappears, and the gastric acidity becomes diminished, we may persevere in the hope of ultimate cure, and the treatment should be prolonged for six months at least. The two indications for surgical treatment appear to me to be, First, persistence of pain and hyperacidity in spite of treatment, and, Secondly, evidence of hypersecretion, or gastric stasis. The presence of these conditions indicate that the anastomotic opening is at fault, and under these circumstances there is little likelihood of complete and permanent cure without surgical intervention. If in the early morning, after ten hours' abstention from food, an acid fluid can be obtained from the stomach, this is sufficient indication of the necessity for surgical treatment.

SURGICAL TREATMENT.

This must necessarily depend on the condition found at operation. Adhesions must be separated and the perforation, if there is one, sutured. A study of the recorded cases plainly indicates that the less extensive the operation performed, the better is the result, especially if marked hyperacidity exist. The anastomotic opening should be carefully examined, and if it is small it should be enlarged or a new gastrojejunostomy performed. The former is in my judgment the preferable course, as being not only simpler, but does not necessitate a "Y" type operation, which for reasons already given is not to be recommended. If on account of severe pain or rapid loss of strength operation has to be undertaken before an attempt has been made to reduce any hyperacidity which is present, I would suggest that the enlargement of the gastrojejunostomy should be deferred, but if on the other hand a strict course of medical treatment has been ineffectual in reducing acidity, then no object is gained by deferring the completion of whatever operative procedure is requisite.

In the cases, unfortunately too numerous, in which after surgical treatment the symptoms recur, I suggest that a gastrojejunostomy " en-Y " should be performed, but with implantation of the proximal limb of the jejunum into the stomach, so that the bile and pancreatic juice are diverted directly into the stomach.

PREVENTIVE TREATMENT.

Our great aim, however, should be the prevention of jejunal or gastrojejunal ulcer, and I will very briefly indicate under two headings, what appear to me the points of importance in this connection, (1) the technic of gastrojejunostomy, (2) the after-treatment.

1. *The Technic of Gastrojejunostomy.*—First, I would emphasize the necessity for a large opening. There is invariably some contraction of the opening, and, in cases of dilated stomach, subsequent diminution in the size of this viscus still further narrows the communication between the jejunum and stomach, and it is perhaps not without significance that in 33 of the recorded cases, the gastrojejunostomy was performed for pyloric stenosis.

Secondly, accurate apposition of the mucous membranes of the stomach and jejunum, so as to secure, if not primary union, at any rate union with the formation of a minimum of scar tissue.

Thirdly, careful application of the inner suture so as to control bleeding, but at the same time to avoid such a degree of tightness as will cause localized necrosis of the tissues.

Fourthly, the use of simple suturing in preference to mechanical appliances, especially when hyperacidity is present.

Fifthly, the avoidance of entero-anastomosis, and of " Y " type operations.

It has been suggested that catgut should be used for the inner suture in preference to silk or linen, because the latter is more apt to serve as a septic focus. This appears to have been the case in one case (Group II, Case 23). I have already alluded to the importance of reducing acidity, and rendering the gastric contents sterile, as aids in securing primary union, and I may add, that personally I prefer the greater security of a linen thread to the use of catgut.

Gastrojejunostomy fundosa as recommended by Goepel, does not, in my experience, give such good results as when the anastomotic opening is placed near the pyloric end of the stomach.

2. *The After-treatment of Gastrojejunostomy.*—The necessity for prolonged after-treatment in cases of gastrojejunostomy has perhaps not received the attention which it deserves. My rule is to advise all patients whose gastric contents have been hyperacid before gastrojejunostomy, to avoid meat in any form for six months at least, and until such time as examination shows that the gastric acidity is subnormal. The immediate relief which is experienced by patients on whom gastrojejunostomy has been performed, tempts them to indulge in food unsuited to the condition of the gastric mucosa. In most cases in which gastrojejunostomy is necessary, the mucous membrane is chronically inflamed, and many months must elapse before it is restored to a healthy condition.

Some surgeons, in their dread of jejunal ulcer, have maintained that gastrojejunostomy is contra-indicated in gastric ulcer with hyperacidity, except when the ulcer is near the pylorus and is causing symptoms of obstruction. Others have even suggested that unless there be gastric stasis, gastrojejunostomy is useless in the treatment of gastric ulcer. I believe this teaching to be retrogressive. For some years I have been advocating the view that gastrojejunostomy is not a drainage operation.

The success which follows this operation in cases of gastric ulcer, is due, not to drainage, but to the physiological effects of the operation in diminishing the acidity of the gastric contents, and this diminution follows gastrojejunostomy irrespective of the situation of the ulcer.

SUMMARY OF CONCLUSIONS.

1. The risk of jejunal ulcer following gastrojejunostomy is probably under 2 per cent.

2. At the present time, this complication apparently occurs less frequently than formerly.

3. Clinically, there are two groups of cases: (1) Those in which perforation into the general peritoneal cavity ensues; (2) those in which general peritonitis is prevented by the formation of adhesions.

4. Pathologically the cases may be classified as follows: (1) Ulcers of the jejunum; (2) gastrojejunal ulcers, or ulcers at the site of the anastomosis.

5. Jejunal ulcers in some instances are of infective origin. In these cases ulceration commences within a very short interval after gastrojejunostomy, and usually the ulcers are multiple.

6. In a large proportion of cases the ulcer is single, and is probably the result of the toxic action of HCl, which injures the cells of the mucous membrane so that they are digested by the intestinal juice. Possibly other agents than HCl may play a part in injuring the mucous membrane.

7. Gastrojejunal ulcers are a direct consequence of the wound made in effecting the anastomosis, and their persistence is probably the result of hyperacidity of the gastric juice.

8. Closure of a gastrojejunostomy opening is the consequence of cicatrization of a gastrojejunal ulcer. It is more likely to occur when the pylorus is patent, not because of the patency of the pylorus, but because in such cases hyperacidity is usually markedly present.

9. Any procedure or disease which diminishes the amount of bile and pancreatic juice in the jejunum, favors the occurrence of jejunal and gastrojejunal ulcer. For this reason operations of the "Y" type and entero-anastomosis are inad-

TABLE XVIII.—ABSTRACT OF CASES OF JEJUNAL ULCER.

The numbers in first column refer to the group and number of the cases as detailed in the Paper (pp. 378–396). Group I: Cases in which general peritonitis occurred. Group II: Cases in which general peritonitis was prevented by adhesions.

No.	Recorder	Sex	Age	Method of gastro-jejunostomy	Interval between gastrojejunostomy and appearance of symptoms	Interval between gastrojejunostomy and second operation	Operative treatment	Result.
I— 1	Braun	M	25	Posterior	11 months		No operation	Death.
I— 2	Hahn	M	?	Anterior	1 year		No operation	Death.
I— 3	Korte	M	30	Anterior	3 years	3 years	Diagnosed as appendicitis	Death.
I— 4	Steinthall	M	44	Posterior (Murphy)	10 days		No operation	Death.
I— 5	Goepel	M	?	Anterior	13 months		No operation	Death.
I— 6	Goepel	M	?	Anterior	4 months	4 months	Suture of perforation	Recovery.
I— 7	Goepel	M	34	Anterior	9 months	9 months	Suture of perforation	Recovery.
I— 8	Tiegel	F	2 mos.	Anterior, with entero-anastomosis	2 months		No operation	Death.
I— 9	Edington	M	39	Anterior	7 years	7 years	Suture of perforation	Death.
I—10	Paterson	M	48	Anterior	2 years		No operation	Death.
I—11	Paterson	M	51	Anterior	2½ years		No operation	Death.
I—12	Hamann	M	48	Anterior, with entero-anastomosis	26 days		No operation	Death.
I—13	Battle	M	30	Anterior (Murphy)	22 months	22 months	Suture of perforation	Recovery.
I—14	Battle	F	30	Anterior	1 year	1 year	Suture of perforation	Recovery; relapse; third operation; cure.
I—17	Key	F	25	Anterior (partial gastrectomy)	10 days		No operation	Death.
I—18	Cackovic	M	30	Posterior	2 days		No operation	Death.
II— 2	Tiegel	M	25	Anterior, with entero-anastomosis	3 months	1½ years	Excision and jejunostomy	Recovery; death after fourth operation.

II— 3	Quénu	M	29	Anterior (Murphy)	1½ years	4½ years	Excision and gastrojejunostomy "En-Y"	Recovery; relapse; jejunostomy; cure.
II— 4	Kocher	M		"En-Y"	3 months	1 year	Excision of ulcer	Recovery.
II— 5	Heidenhain	M	48	Anterior	? months	? months	Suture of perforation	Recovery; relapse; new gastrojejunostomy; cure.
II— 6	Kreuzer	M	36	Anterior	1½ years	5¾ years	Suture of perforation	Recovery; relapse third operation; cure.
II— 9	Neumann	M	24	Anterior, with entero-anastomosis	6 months	1 year	Excision of ulcer	Recovery.
II—11	Tiegel	M	33	Anterior, with entero-anastomosis	1½ years	4¼ years	Suture of perforation	Recovery; relapse.
II—13	Brodnitz	M	58	Anterior	3¾ years	3 years, 10 mons.	Resection and gastrojejunostomy "En-Y"	Recovery; relapse third operation; cure.
II—14	Robson	M	44	Anterior	2 years	3 years, 4 mons.	Resection and gastrojejunostomy "En-Y"	Recovery.
II—15	Jahr	M	29	Anterior, with entero-anastomosis	8 months	1¾ years	Excision of ulcer	Recovery.
II—16	Hofman	F	22	Anterior, with entero-anastomosis	6 years	6 years	Excision of ulcer	Recovery.
II—21	Cackovic	M	30	Anterior	8 months	13 months	Suture of perforation	Recovery.
II—22	Key	M	39	Anterior	6 months	2½ years	Suture of perforation	Recovery; relapse.
II—24	Key	M	26	Anterior	4 years	5 years	Suture of perforation	Recovery.
II—25	Key	F	26	Posterior	6 weeks	7 weeks	Gastrojejunostomy "En-Y"	Death.
II—26	Rotgans	M	?	Anterior	?	?	Excision of ulcer	Recovery.
II—27	Cackovic.	M	36	Anterior.	3 days	16 days	Suture of perforation and entero-anastomosis	Recovery.
II—28	Paterson	F	47	Anterior	3 years	5 years	Resection of jejunum and gastrojejunostomy "En-Y"	Recovery; relapse; recovery.
II—29	Kaufmann	M	41	Anterior, with entero-anastomosis	3 months	3¾ years	Closure of gastrocolic and jejunocolic fistula	Death.
II—31	Gosset	M	40	Posterior	1½ years	22 months	Closure of jejunocolic fistula	Recovery.
II—32	Herczel	?	?	Posterior	?	?	Closure of jejunocolic fistula	?
II—33	Cackovic	M	38	Posterior	3 years, 2 mons		Died 6 years after gastrojejunostomy	Death; no operation.

TABLE XIX.—ABSTRACT OF CASES OF GASTROJEJUNAL ULCER (ULCER AT SITE OF ANASTOMOSIS).

The numbers in first column refer to the numbers of the cases as detailed in the Paper. Group I: Cases in which general peritonitis occurred. Group II: Cases in which general peritonitis was prevented by adhesions.

No.	Recorder	Sex	Age	Method of gastro-jejunostomy	Interval between gastrojejunostomy and appearance of symptoms	Interval between gastrojejunostomy and second operation	Operative treatment	Result.
I—15	Graser	F	?	Posterior (Murphy)	3 years		No operation	Death.
I—16	Key	F	45	Anterior "En-Y"	7 years	7 years	Suture of perforation	Recovery.
I—19	Delaloye	M	41	Anterior	3¼ years		No operation	Death.
II—1	Mikulicz	M	32	Anterior	4 months	Over 4 months	Suture of perforation and entero-anastomosis	Recovery; relapse.
II—7	Czerny	M	59	Posterior	8 years	9 years	Excision of ulcer and gastrojejunostomy "En-Y"	Death.
II—8	Czerny	M	42	Posterior (Murphy)	6 months	1¼ years	Partial gastrectomy	Death.
II—10	Mikulicz	M	53	Anterior with entero-anastomosis	8 months	4 years, 4 months	Suture of perforation	Death.
II—12	Schloffer	F	31	Anterior with entero-anastomosis	3 months	1 year, 3 months	New gastrojejunostomy	Recovery; relapse; later operation; cure.
II—17	Hofman	M	45	Posterior	1 year	5 years	New gastrojejunostomy (Murphy)	Recovery.
II—18	Schostak	M	22	Anterior	1 year	2¼ years	Suture of perforation, entero-anastomosis	Recovery.
II—19	Schostak	F	18	Anterior	1 year	1 year, 10 months	Excision, gastrojejunostomy "En-Y"	Recovery; relapse; later operation; recovery.
II—20	Connell	?	?	Anterior	2 years	3 years	New anterior gastrojejunostomy	Recovery.
II—23	Key	F	38	Anterior	3 months	2 years, 8 months	Resection of jejunum, gastrojejunostomy "En-Y"	Recovery; relapse; operation; death.
II—30	Czerny	M	36	Posterior (Murphy)	1½ years	2 years	New gastrojejunostomy	Recovery.

TABLE XX.—ABSTRACT OF "DOUBTFUL" CASES OF JEJUNAL ULCER.

No.	Recorder	Sex	Age	Method of gastrojejunostomy	Interval between gastrojejunostomy and appearance of symptoms	Symptoms and signs	Result.
1A	Fraenkel	?	?	Anterior with entero-anastomosis	11 months	Fecal abscess	Recovery.
2A	Tiegel	M	41	Anterior with entero-anastomosis	2 years	Pain, resistance in abdomen	Recovery and relapse
3A	Hahn	?	?	?	?	Abscess of abdominal wall	Recovery.
4A	Hahn	?	?	?	?	Abscess	Recovery.
5A	Cackovic	F	40	Anterior	6 days	Pain, swelling of abdominal wall	Recovery.
6A	Lyle	M	26	Posterior with entero-anastomosis	6 months	Symptoms of gastric ulcer	Relief.
7A	Schostak	M	70	Anterior	1 year	Pain, tender induration	Recovery.
8A	Hadra	M	?	Anterior	6 months	Pain, infiltration of abdominal wall, gastric fistula	Recovery.
9A	Paterson	M	76	Anterior (Murphy)	5 years	Pain, swelling in left rectus, adhesions round jejunum	Gastrolysis; relief.
10A	Nyrop	?	?	?	?	?	?
11A	Unpublished	M	47	Posterior	4 years	Pain, resistance	?

visable, at any rate in cases in which free HCl is present in the gastric contents, as after these procedures the anastomosis and a portion of the jejunum are deprived of the protective influence of the alkaline bile and pancreatic juice.

10. The reason that ulceration has followed the anterior operation more frequently than the posterior operation with a loop, is probably that in former times the anterior operation was more frequently performed.

11. As no instance of ulcer after the posterior no-loop operation has yet been recorded, we must for the present assume that its occurrence after this type of operation is less likely. It is possible, however, that this immunity is partly the result of improvements in technic, and in the after-treatment of gastric operations in general.

12. In cases in which perforation into the general peritoneal cavity occurs, immediate laparotomy offers the only chance of saving the patient's life.

13. Inasmuch as there is some evidence that jejunal and gastrojejunal ulcers may heal, an operation should not be performed in the chronic cases, until after a thorough trial of medical treatment.

14. Even when surgical intervention is necessary, an attempt should first be made to diminish hyperacidity, if this be present.

15. Our aim should be to prevent the occurrence of this complication of gastrojejunostomy. Preventive treatment consists in (1) careful and appropriate surgical technic, and (2) prolonged after-treatment.

16. Lastly, every case of recrudescent pain of a constant character after gastrojejunostomy, especially when associated with hyperacidity or hyperseretion, should be regarded as a case of potential ulcer, and treated accordingly.

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SURGICAL PROCEDURES DESIGNED FOR THE RELIEF OF PULMONARY TUBERCULOSIS.*

BY CHARLES A. POWERS, M.D.,

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A COMPLETE historical review of this subject has recently been made by Parascondolo (*Wien. med. Woch.*, 1907), to which article those interested are respectfully referred.

In 1902 De Forest Willard presented an exhaustive *résumé* of "The Surgical Treatment of Tubercular Cavities of the Apex of the Lung," in his Chairman's address before the Section on Surgery of the American Medical Association (*Journal Am. Med. Assoc.*, 1902) and furnished a carefully prepared list of all operations from 1844 to 1901 inclusive—73 in number. This paper was complete at the time and is accessible now. Since its appearance there have been few published reports of operative procedures for pulmonary tuberculosis aside from those relating to the production of an artificial pneumothorax. Careful search reveals but one published case of pneumectomy, four cases of pneumotomy, three cases of chondrotomy, and, exclusive of the work of Freidrich,† seven cases of thoracoplastics.

Artificial pneumothorax by the insufflation of nitrogen seems to have been first employed by Forlanini, in 1882, who reported his results to the Eleventh International Congress at Rome, in 1892. It was made the subject of careful study by Murphy in an address before the American Medical Association, in 1898. While at present it is practically without therapeutic place in this country, it is interesting to note that it finds employment in Europe, as witness recent papers by Brauer (1909), Forlanini (1908), Samson (1908), Bunzl,

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* Read before the American Surgical Association, June 4, 1909.

† For this important article by Friedrich, see ANNALS OF SURGERY, July, 1909, p. 135.

Schmidt and others. In the Marburg Clinic Brauer uses it constantly and reports encouraging results.*

The single case of pneumectomy of which the writer has been able to learn since the publication of Willard's paper is reported by Glück. Multiple costal resection followed by excision of the lower lobe of the right lung proved speedily fatal.

Pneumotomy with drainage of a tuberculous cavity does not seem to have proved of encouraging value. In 1897 Tuffier collected twenty-six cases with thirteen deaths. In the literature of the seven years which follows Willard's paper the writer finds but four cases (Haentjens, Landerer), two of these proving immediately fatal. The writer has employed this procedure but twice, in each case draining a cavity in a lower pulmonary lobe.

In the first instance a man of 42 years suffered from a fairly large cavity in the left lower lobe. Costal resection, pleuræ found adherent; the lung was incised and the cavity entered at a depth of about 1½ inches. Drainage. Improvement was but temporary, a sinus persisted and the patient succumbed to tuberculosis in a few months.

In the writer's second case a tuberculous woman of 27 years came to Colorado from Tennessee. She gave a history of a pulmonary tuberculosis of six months duration; she had lost in flesh and strength and had a purulent expectoration of 6 ounces daily. She was supposed by the writer to have an encapsulated empyema just below and within the angle of the right scapula. Costal resection, pleuræ found adherent. Pleural separation discovered no pus. A needle thrust in the lung withdrew pus. Incision, a moderate cavity was entered at a depth of about one inch. Trabeculæ were broken down, gentle curettage was made. Drainage. Bacteriological investigation showed a mixed infection. This patient underwent a fairly speedy improvement. At the time of last report, one year after operation, the woman had gained materially in flesh and strength; expectoration was practically nil. A discharging sinus persisted.

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* The writer believes this procedure worthy a more extended trial.

It it not without interest to note that Koerte and Schlange have recently advocated, on theoretic grounds, the opening and packing of well localized, hæmorrhagic cavities.

Mobilization of the upper thoracic wall by chondrotomy of the first rib or first two ribs, with or without resection of the costal segment, was first advised by Freund, whose studies led him to assert that the first rib has a very short, thickset, somewhat changed structure, in tuberculous affections of the apex. This gives, in the first place, a changed configuration to the upper aperture of the thorax, which becomes narrower and smaller, its diameter being shortened in all directions. In the second place, the angle of inclination of the upper thoracic aperture is altered, in the sense of being enlarged. Through this change of the anatomical structure the inspiratory movement of the thoracic aperture is inhibited, or fails to occur. The upper apical portions of the lung are insufficiently aërated. This imperfect aëration of the lung is demonstrable by the fact that numerous cases prevent the impressions of the first ribs in the pulmonary apices. This imperfect aëration creates a predisposition to apical affections of a special character; and it has been demonstrated by Schmorl that tuberculosis is apt to begin at these points. These observations of Freund have recently been confirmed by the investigations of Hart, who states that an arrest of development may cause a stenosis of the upper thoracic aperture, while senile changes may have the same outcome. In the course of years the stenosis of the upper thoracic aperture may be compensated, and apical affections may heal through improved respiratory conditions.

In order to obtain a sufficient aëration of the compressed upper portions of the thorax, Freund proposed to operate upon the first costal cartilage, and establish pseudoarthroses. Individuals suffering from a stenosis of the upper thoracic aperture are said to be recognized on the basis of Freund's description of the findings elicited by inspection, palpation, mensuration, and examination of the cartilage through insertion of needles. Radiography is also of great diagnostic importance. The interference, the technic of which is simple, is regarded by Freund as indicated in cases of recurrent apical affections in individuals with a tuberculous family history. The existence of other tuberculous processes excludes the intervention. In case the tuberculous process in the apex has extended beyond the second rib, the patient should be denied operation.

Hart aims at relieving functional disturbances of the first rib referable to senile changes through this operation. Further, incipient juvenile tuberculosis, according to him, should be at once subjected to operation in order to create a new joint through which the compressed upper aperture is lifted out, as it were. He insists upon timely performance of the operation, which should not be delayed by a preliminary sanatorium treatment; this may, however, be instituted after operation. Even the prophylactic division of the first rib should not be refrained from, in certain cases.

Hofbauer opposed the views expressed by Freund, stating that this affection concerns not alone anatomical changes but that an important part is also played by the physiological side of respiration. As the shape of the thorax has nothing in common with the disease, such operation is superfluous, in his opinion, in the majority of cases. He would reserve it for those cases of apex-tuberculosis in which immobilization of the thorax actually exists. In all remaining cases an improvement of the respiration may be obtained by sufficient breathing exercises, as the capacity of extension of the corresponding thoracic region is an adequate one.

In the literature which has appeared since the publication of Willard's paper in 1902, the writer finds but three cases of chondrotomy. Kausch reports at the end of three weeks on an instance of resection of an ossified first costal cartilage with some adjacent bone. Seidel reports two cases in each of which resection of the first and second cartilages was made, each patient being improved at the time of discharge.

In this connection the writer may be permitted to say that

Bonney of Denver has recently conferred with him regarding the case of a youth who had a small, frequently bleeding apical cavity. The young man succumbed to a severe hemorrhage. Autopsy showed the cavity to be practically the only tuberculous area. Bonney says that in a similar instance in the future he would be inclined to recommend upper rib resection with firm external pad pressure.

Major thoracoplastics, or multiple rib resection, has been brought to definite notice recently by Friedrich of Marburg. A lesser thoracoplastic procedure than that of Friedrich has been carried out of late by Mosheim and Landerer—once by the former, and six times by the latter.

Mosheim's patient died at the end of eight months. Landerer has resected the ribs from the first to the fourth, inclusive, in two instances; from the fifth to the ninth, inclusive, in two instances; from the fourth to the ninth, inclusive, in one instance; and from the second to the eighth, inclusive, in one instance. In one of these patients Landerer opened a lower lobe cavity on the seventh day. This patient is reported as improved at the end of two and a half months. In two of the remaining cases improvement was noted at the time of an early report, in one case report of improvement is made ten months after operation, and in another case eight months after operation. In the remaining case arrest without improvement is noted.

The writer will not attempt to speak of the very extensive rib resection as practiced by Friedrich. He had the pleasure of seeing one of these interesting operations performed by that distinguished surgeon in Marburg last summer, and was much impressed by the skill and rapidity with which this formidable procedure was carried out on a young man in advanced and progressing right-sided tuberculosis. He was also impressed by the attentive care which Friedrich gives to these cases before and after the operation itself. He ventures the thought that it is probable that surgical aid will be extended to the victims of pulmonary tuberculosis more successfully in the future than it has been in the past, and that this aid will lie in the direction of lung shrinking without permanent pleural opening rather than in that of the drainage of pulmonary cavities.

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A CASE OF PISTOL-SHOT WOUND OF THE AXILLARY ARTERY.*

LIGATION OF FIRST PORTION: RECOVERY.

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AMONG the gunshot wounds one meets with in civil practice, it is rare to see one in which an injury of a large artery is the sole or principal lesion. Death from primary hemorrhage, either immediately or before surgical aid can be obtained, is the fate of most of these cases, and should the wounded person escape the dangers of primary hemorrhage, or even in the event of absence of any external bleeding, as may be the case when the wound of the artery is a small one, there still remains the danger of secondary hemorrhage, which is so often fatal. In the axilla the conditions are very favorable for secondary hemorrhage, as, owing to the slight resistance offered by the loose areolar tissue, blood freely escapes from the wounded artery, and from the size and easy distensibility of the axillary cavity, a large hæmatoma forms more or less rapidly. The tendency of the hæmatoma is to extend toward the surface, and, after a time, generally a few days, to burst through the skin, and the inevitable secondary hemorrhage follows; and the same result may follow the softening of the mass through infection. While not always fatal, the hemorrhage may often cause a degree of anæmia, which makes the case a bad operative risk. Some three years ago there came under my care a case of pistol-shot wound of the axillary artery, the history of which I present not only on account of its infrequency and the successful result of operation, but also because it contains some points worthy of consideration, if not discussion. The history of the case is as follows:

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* Read before the New York Surgical Society April 14, 1909.

S. S., 33 years of age, police officer, was admitted at 10 A.M., March 16, 1906, to the New York Hospital. Shortly before admission he was shot in the right shoulder by a man who was a few feet above him on a staircase, and whom he was attempting to arrest. Immediately following the shot he felt a stinging sensation in the shoulder, and his arm, which was extended and raised preparatory to shooting at his assailant, fell helpless to his side and the pistol dropped to the ground. He suddenly became dazed and faint, and was carried by his brother officers to a nearby stable where his shirt and undershirt, soaked with blood, were removed, and the bullet wound, from which blood was trickling, was discovered. An ambulance was called, and after the wound was dressed by the surgeon, the patient was hurried to the hospital.

On admission he was in considerable shock, and complained of severe pain in the right shoulder; pulse 90 and rather soft. An inch below the inner third of the right clavicle there was a pistol-shot wound, three-eighths inch in diameter and with ragged and inverted edges. Over the axilla and lower pectoral region the skin was ecchymosed, and a large swelling could be felt in the axilla. The arm was colder than its fellow, the superficial veins were moderately distended, and brachial and radial pulse were absent. Over the outer surface of the arm, and over the exterior surface of the forearm, there was anæsthesia, and complete paralysis of the extensors of the wrist and hand was present. During the examination active hemorrhage from the wound set in, but was controlled by iodoform gauze packing. When seen by me an hour later the patient was in less shock, but the axillary swelling had increased and it was now the size of a child's head at term; it was non-pulsating and no murmur could be detected over the region of the wound. The right arm was cold, somewhat cyanosed and the superficial veins extremely distended. There was now loss of motion in the entire upper extremity, and, with the exception of a small area on the inner side of the arm, the loss of sensation was complete. About an inch below the spine of the scapula and near the inner edge of the bone, there was a swelling, and in its centre could be felt a small, hard object—evidently the bullet. Shortly afterward the patient was removed to the operating room, and under gas and ether anæsthesia, the patient in dorsal position, the right arm in extreme elevation, the axilla was exposed by a five-inch incision beginning just below the inner end of the clavicle and extending directly outwards through the bullet wound to a point about an inch posterior to the anterior fold of the axilla. Skin, fascia and the large pectoral muscle were successively divided, all bleeding vessels ligated as they were met, and in order to obtain a better exposure of the axilla, the wound was enlarged by a second incision, starting at the outer end of the first and running down behind the anterior axillary fold for about three inches. The triangular flap thus formed was retracted downwards and inwards; after sponging away a number of small clots, the lesser pectoral muscle was located and cut through near its insertion. About an inch to the inner side of this muscle the hole made by the bullet in the bulging costocoracoid membrane was seen and while cutting through this membrane profuse hemorrhage began at this point. The left index finger was quickly inserted into the clot at the bleeding point and pushing forward it came down upon the wound in the artery and the hemorrhage was immediately controlled by pressure. The clots in the apex of the axilla were removed sufficiently to allow compression of the artery against the ribs by the finger of an assistant and my index was removed. No bleeding followed, and on sponging the clots away the artery was exposed and a lateral wound on its anterior and inferior aspect, and involving half the diameter of the vessel, was found. The axillary vein was found to be intact and was separated from the artery by a large clot. An aneurism needle threaded with No. 3 plain gut was passed from within outwards across the artery, and with some difficulty, as the artery was displaced upwards and was surrounded by one or two large nerves; and the artery was ligated about one-quarter inch to the inside of the wound. On bringing the arm down toward the side of the body, blood gushed from the distal end of the wound in the artery, and was immediately checked by again elevating and abducting the arm. A distal ligature of plain gut was then applied about the vessel and tied and the artery was *severed* between the ligatures. All hemorrhage having ceased, the axilla was emptied of the remaining clots and after irrigation with salt solution, the wound was sutured. Interrupted chromic sutures were used to unite the ends of the severed pectoral muscles, plain gut for the fascia and silk for the skin; and a large cigarette drain was inserted at the lower angle of the axillary incision. With the patient on his side, a small incision was made over the site of the bullet, and it together with a small fragment of bone and also a small piece of cloth were removed. With a probe a small hole could be felt near the edge of the scapula, where the bullet—a No. 38—had perforated the bone. Sterile gauze dressing was applied over the wounds, the arm was fastened to the side by a binder and the hand and forearm were enveloped in cotton.

Operation lasted about an hour and a half, and the patient left the table in fair condition, with a pulse of 116 and of good force. Prompt recovery from the immediate effects of the operation followed, and the post-operative history was one of steady improvement. For two or three days there was a very free drainage of blood-stained serum from the axilla, and it steadily decreased until the eighth day, when the drain was removed. The wounds healed kindly without suppuration. The circulation of the arm was rapidly restored, and on the day following the operation the arm had recovered in great measure its normal appearance and warmth. A faint radial pulse was detected on the second day and it steadily grew stronger, but it was slightly weaker than the left radial pulse, at the time of the patient's discharge. The loss of motion and sensation remained complete for three days, and after that there was a very gradual return, but on April 2, when the patient left the hospital, the arm was of little use. There was paralysis of the musculospiral, the median and the musculocutaneous nerves. The patient was referred to Dr. J. Ramsey Hunt for treatment. The arm was treated by massage and electricity, and it was not until November that any improvement was noticeable, when there was slight flexion of the elbow and pronation and supination.

For four months there was great suffering from pain in the arm, due to the traumatic neuralgia so common in these nerve injuries, but it ceased in September. The improvement noted in November continued and gradually all movements of the arm returned with restoration of sensation, and in the autumn of 1907 the patient was discharged cured from Dr. Hunt's clinic. A recent examination of the patient found him in excellent condition and the arm almost as good as it was before the injury. Owing to retraction in the axilla, the right arm cannot be elevated completely, and there is also slight weakness of the thumb extensors.

The injury of the artery was due to the fact that the shooting was at close range, when the bullet was travelling at high velocity. At long range, large arteries are seldom injured, owing to their resiliency and the slower movement of the missile. It is to be noted that at the time of the injury, the right arm was elevated and extended, a position in which the axillary vessels and nerves are more exposed to injury.

The diagnosis of a wound of a large artery may at times be difficult, especially when there has been no external bleeding or when the primary hemorrhage is of brief duration and there are no signs of hæmatoma. These conditions are most often seen in wounds of the popliteal or the femoral artery by a small calibre missile, and are due to the firm fascia and aponeurosis surrounding these vessels. In the axilla, where the anatomical conditions are different, the diagnosis of a wound of the axillary is far easier; but it is not always possible to ascertain whether the artery is completely severed or not. In the case just reported it was quite evident that the artery had been injured, as there was the history of a severe primary hemorrhage and the presence in the axilla of a steadily increasing hæmatoma, and it is of interest to note that both the peripheral pulse and Von Wahl's sign were absent; and their absence indicated a complete rupture of the vessel, whereas at operation the artery was found to be partially sound. The absence of pulsation and the systolic bruit described by Von Wahl were no doubt due to the presence of the large axillary hæmatoma, and an examination immediately after the shooting might have shown them present. Von Wahl's sign is of great assistance, however, in cases when external hemorrhage and the presence of hæmatoma are wanting, as in wounds of the popliteal artery by a small-calibre bullet, and under such conditions the presence of the systolic bruit indicates incomplete rupture. Cases are recorded where the early detection of the systolic bruit was the cause of prompt and successful operation.

The treatment of gunshot wounds of the axillary artery is identical with that of any large artery, and consists of immediate control of the hemorrhage by compression, and the transport of the wounded person to some place, preferably a hospital, where the provisional hæmostasis is made permanent by ligation of the artery.

The provisional hæmostasis should be carried out promptly and in a proper manner, as the life of the patient so often depends on it; but too often the injury occurs under conditions where, owing to delay, the necessary aid comes too late. In the case quoted the patient was in the hospital very soon after he was shot, and the hemorrhage which recurred shortly after admission was promptly controlled by packing the wound tightly with iodoform gauze.

Permanent hæmostasis is only to be secured through cutting down on and exposing the artery by a sufficiently large incision and then ligating the vessel on the dorsal and proximal sides of the wound. For years it was a subject of controversy whether one should ligate the third portion of the subclavian, or expose the axillary and ligate above and below the wound in the artery; and while most surgeons at the present time advocate the latter procedure, there are others who prefer ligation in continuity. Their preference may be due to the fact that ligation of the subclavian is the easier operation, or it is from failure to recognize that the treatment of a wound of the axillary artery is not the same as that of axillary aneurism. The hæmatoma which surrounds the wounded artery is in no sense an aneurism, and it is misleading to speak of it as "diffuse traumatic aneurism," or "false traumatic aneurism"; a better term would be "diffuse hæmatoma." The hæmatoma following wounds of the axillary seldom organizes, its tendency is to steadily increase in size and burst outwards, or to break down through infection, with secondary hemorrhage the result in either case. To treat a wound of the axillary artery by ligation of the third portion of the subclavian is practically the same as if one ligated the artery on the proximal side of the wound, and left the distal end to care for itself. Owing to the free anastomotic circulation of the artery, secondary hemorrhage is to be expected;

and the case quoted is a practical illustration, as the proximal ligature was tied so high up on the first portion of the artery that the anastomotic circulation was identical with that following ligation of the subclavian in its third part. After the proximal ligature was tied it was noticed that the distal end of the wound did not bleed; probably from the position of the arm in extreme extension and abduction.

On bringing the arm downward to the side, blood gushed from the wound in the artery and was immediately checked by replacing the arm in its former position. The force with which the blood issued from the wound was striking, and it was a practical demonstration to me of the inefficiency of ligation in continuity to prevent secondary hemorrhage. The operation should be performed promptly, and if the patient is in shock or very weak from loss of blood, stimulation, infusion of sterile salt solution, and direct transfusion of blood if possible for severe anæmia are indicated, and as soon as there is marked improvement the artery should be tied. Operation should be performed if possible in the first twenty-four hours following injury, and not later than the second day, as the longer one waits the more difficult it is, and the greater the chance of secondary hemorrhage. The artery should be exposed by an incision through the skin and great pectoral muscle, and the incision should be ample enough to give a free exposure of the axilla, and thus allow the surgeon to locate quickly the wound in the artery. The incision recommended in the text-books on operative surgery for ligation of the axillary artery is insufficient and of little use when the axilla is filled with a large hæmatoma. The incision used by me was very satisfactory, and, while in certain cases it might be smaller, it gives a good exposure when one has to ligate the first or second portion of the artery for hemorrhage. By careful attention to the small vessels and tying them as they are cut, little blood is lost, and under proper aseptic precautions the wound heals kindly. While it is not an easy operation, it is also not a difficult one, and I was impressed by the comparative ease with which I secured the artery in the wound.

As it meets the indication for the prevention of secondary hemorrhage, it is thus superior to the ligation of the third portion of the subclavian. The treatment of injuries of the blood-vessels by suture has received increased attention during the past five years, and the result demonstrated that plastic surgery of the arteries and veins has passed the experimental stage and is of therapeutic value.

Lateral suture of wounded veins and arteries has often been successful, and the results of circular arteriorrhaphy in the few cases reported are such as to lead us to expect an extended use of the procedure in the future.

Further experience and improved technic are, however, necessary before definite conclusions can be drawn as to what extent and in which cases the suture shall displace the ligature. In wounds of arteries like the common carotid, the femoral and the popliteal, where ligation is often followed by serious disturbances, the suture, when possible, is indicated; but circular suture of a large artery is a difficult procedure, and in the hands of one not experienced in the technic, the results are not likely to be very satisfactory. In wounds of the axillary artery, owing to the free anastomotic circulation, the suture presents no advantage over the ligature, and is rather inferior, as it consumes more time, which is an important element in these cases. The advocates of the suture state, that, if it fails, then we can use the ligature afterwards, and their statements hold good as regards wounds of the femoral, popliteal and brachial arteries; but in the case of the axillary, the ligature, in my opinion, is to be preferred. The nerve complications in the case quoted are of some interest. The complete sensory and motor paralysis of the arm, which appeared soon after the injury and which remained stationary for three days, then gradually disappeared, was due to the presence of the axillary hæmatoma.

The paralysis of the musculospiral, median and musculocutaneous nerves suggests a lesion of the outer and posterior cords of the brachial plexus, either a contusion or slight laceration; and in Dr. Hunt's opinion the nerves were not severed by the bullet.

Owing to the infiltration of the axilla by blood it was impossible to distinguish the various cords, and as a search under such conditions would involve more time than the patient's condition allowed, it was deemed wiser to wait until later on. It was decided at the time of discharge of the patient from the hospital to try electricity and massage for six months, and then if there was no improvement to attempt suture of the paralyzed nerves. As slight flexion at the elbow, pronation and supination were present in November, it was concluded to watch and see if the improvement continued before deciding on operation. From November the motion in the paralyzed muscles gradually returned, together with sensation, and early in the autumn of 1907, some eighteen months after the injury, the restoration of function and sensation was almost complete, and treatment was discontinued.

Fully appreciating that the case which has been reported is one which we rarely see in civil practice, I have, nevertheless, deemed it of sufficient importance to be the subject of this brief paper, as it is an example of the superiority of the "old operation" over ligation in continuity, when one is called upon to treat a gunshot wound of the axillary artery.

THE TREATMENT OF DIFFUSE SEPTIC PERITONITIS.*

BY ROBERT G. LE CONTE, M.D.,

OF PHILADELPHIA.

For the purpose of again bringing before the Society the subject of diffused septic peritonitis, I desire this evening briefly to report the cases which came under observation in my wards during the first month of my service this year in the Pennsylvania Hospital. They are nine in number, and in their admissions cover a period from February 5 to March 1, 1909. Three were operated upon by myself and six by my assistant, Dr. Francis T. Stewart. In my cases the essentials of the Murphy treatment were practiced: namely, a speedy operation; removal of the cause with the least possible traumatism to the peritoneal surface; no douching of the peritoneal cavity; the exaggerated Fowler position; and continuous enteroclysis by the drop method.

In Dr. Stewart's cases the peritoneal cavity was flushed with warm saline solution. The head of the bed was but slightly raised, the patients lying on the back or being turned on the right side, and salt solution was given by rectum—six fluid ounces every fourth hour.

In this series of cases there was but one death, which occurred on the fourteenth day after operation, probably from secondary infection of the liver plus secondary hemorrhage. A post-mortem examination was not allowed. In all instances the patients arrived in the hospital in such serious condition, that they were at once transferred from the receiving ward to the operating room.

Case I.—*Gall-Stones in Gall-Bladder and Common Duct; Pancreatitis; Diffused Fat Necrosis; Diffused Peritonitis.*—S. B., white, female, ætat 42, born in the United States. Admitted February 5; temperature 98.6°, pulse 118, leucocyte count 32,650.

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* Read before the Philadelphia Academy of Surgery, April 5, 1909.

Previous History.—Twelve years ago she had a series of attacks of epigastric pain which lasted for a period of three years.

Present illness dates from October, 1908, when she began having severe attacks of pain in the epigastrium, which would double her up and last on an average about an hour, associated always with severe constipation. These attacks were always sudden in onset and sudden in cessation. After some of them she thought she was slightly jaundiced for a day or two. February 3 she had a sudden severe attack after supper, lasting three hours. The next morning at 6 A.M. the pain again began, but was diffused over the abdomen. The pain has been continuous since then, with vomiting. There is general tenderness and rigidity over the abdomen, most marked about an inch above the umbilicus in the median line. No bowel movement for three days.

Operation (Stewart).—Longitudinal incision over right rectus. On opening the peritoneum there was an excess of bloody, turbid fluid; peritoneum injected. A fat necrosis 1 to 2 mm. in diameter was visible over the omentum and parietal peritoneum; gall-bladder small, contracted, thick-walled, filled with stones; intestines injected and hyperæmic; pancreas enlarged and firm. Gall-bladder opened, many faceted stones removed. One stone found in the common duct required an incision of the duct to remove it. Common duct and gall-bladder drained with rubber tubes. Abdomen irrigated with hot saline solution. Gauze drain in peritoneal cavity. Duration of operation, about an hour. Convalescence was slow but uneventful. Drainage ceased March 1. Patient was discharged March 10, wound entirely healed and in good condition. It is interesting to note that the drainage of bile from the common duct averaged about 6 fluid ounces a day, while from the gall-bladder but a little over 2 fluid ounces was recovered daily. Laboratory report on specimen of omentum: Fat necrosis.

CASE II.—*Gangrenous Perforative Appendicitis; Walled-off Abscess which had Ruptured into the General Peritoneal Cavity.*—W. S., male, ætat 18, born in United States. Admitted February 10. Temperature 101.6°, pulse 104, respiration 24. Has had pain in lower right abdomen for one week. Forty-eight hours before admission he was prostrated by this pain with vomiting. No chills noted. Abdomen tense, rigid, tender, with mass the size of a small fist in the right inguinal region.

Operation (Le Conte).—Small incision parallel with Poupart's ligament, over outer border of tumor. On entering the peritoneal cavity much thick, inflammatory lymph was seen, entirely masking the head of the colon. A flaccid abscess cavity was palpated through this walled-off area. As the abscess had evidently evacuated itself into the general peritoneal cavity, a second incision was made through the rectus muscle opening the general peritoneal cavity, where considerable free, foul-smelling pus was found. The intestines were injected and in places coated with lymph. Gauze packs were inserted and the abscess cavity freely opened through this second incision. The gangrenous, perforated appendix was excised. The abscess cavity was packed and drained through the first incision, and the pelvis drained with a rubber tube through the second one. Murphy treatment. Recovery was uneventful. Drainage ceased February 27, and patient was discharged March 11, with a small granulating area in the outer wound.

CASE III.—*Gangrenous Appendicitis; Diffuse Peritonitis.*—J. G., ætat 22, male, born in Russia. Admitted February 15, complaining of general abdominal pain. Temperature 101°, pulse 100, respirations 40, leucocyte count 26,200.

Present illness began two days ago with severe generalized abdominal pain and vomiting; no chill. Examination of abdomen showed signs of diffused peritonitis.

Operation (Le Conte).—Incision through right rectus; a considerable amount of free fluid and foul-smelling pus was evacuated on opening the peritoneal cavity. Appendix firmly bound down with recent lymph. At its base was a large gangrenous area, through which a concretion could be felt. No gross perforation was detected. Murphy treatment. Patient reacted well and improved nicely for four days. Some distention of the abdomen was then noted, with nausea and vomiting. For the next week there was an irregular temperature, with free discharge through the drains, but the abdominal distention continued with occasional vomiting. On the 25th and 26th the dressings were moderately saturated with blood. On the 27th several large blood clots were evacuated from the wound. The wound was irrigated with salt solution and firmly packed with gauze. At 10 P.M., signs of hemorrhage continuing, the wound was again irrigated and the cavity again firmly packed with gauze. This seemed to control the bleeding. At 6 A.M. on the 28th the pulse rapidly failed, but no hemorrhage was visible from the wound. At 10 A.M. jaundice was noted in the skin and eyes. Pulse continued very poor in spite of free stimulation and enteroclysis. At 11 A.M. three pints of saline solution were given through the left brachial vein, but the patient did not respond and died at 11.50 A.M. Post-mortem not allowed. The examination of the wound after death showed but very slight hemorrhage in the abdominal cavity or on the dressings. The cause of death was attributed to a secondary infection of the liver, as evidenced by the jaundice, and secondary hemorrhage, due to a necrotic retroperitoneal area.

CASE IV.—*Gangrenous, Perforative Appendicitis; Diffuse Peritonitis.*—J. K., white, male, ætat 14, born in Russia, admitted February 17. Suffered at different times from indigestion. Had been ill three days with abdominal pain which began about the umbilicus and rapidly settled in the right lower quadrant, with vomiting and fever. On admission temperature 102°, pulse 96, respirations 32. Abdomen distended, rigid and tender, particularly over the region of the appendix.

Operation (Le Conte).—Incision through the right rectus. On opening the peritoneal cavity, turbid, flaky fluid poured out; intestines injected and in places coated with lymph; appendix for the most part rectrocæcal, gangrenous and ruptured; removed. Appendix region drained with gauze, and pelvis with rubber tube. Wound not sutured. Murphy treatment. Recovery uneventful. Out of bed March 5, and discharged March 13 with small granulating area in the region of the wound.

CASE V.—*Gangrenous Perforative Appendicitis; Diffuse Peritonitis.*—I. S., white, female, ætat 7, born in Philadelphia. Admitted February 17. Temperature 101.8°, pulse 128, respirations 32. Sudden abdominal pain forty-eight hours before admission, with chill and fever. Pain at first generalized over abdomen, became localized in the right lower quadrant, later again to become general. Vomiting frequent.

Operation (Stewart).—Incision through the right rectus. On opening the peritoneum foul-smelling, sero-purulent fluid was evacuated. Appendix was thick, highly inflamed, with a rupture of its distal end. Excised. Profuse lavage of the peritoneal cavity. Bed of appendix drained with gauze. Two silkwormgut sutures inserted to close the incision above the drainage. Recovery uneventful. March 15, out of bed, and discharged from the hospital March 20, wound entirely healed.

CASE VI.—*Gangrenous, Perforative Appendicitis; Diffuse Peritonitis; Pregnancy.*—V. H., white, female, ætat 27, born in United States, admitted February 23. Temperature 100.6°, pulse 120, respirations 22. Two days previous to admission was taken suddenly ill with severe pain in the right iliac fossa and almost continuous vomiting. Patient four months pregnant. Abdomen distended, rigid, and particularly tender in the right iliac fossa.

Operation (Stewart).—Incision through the right rectus, and on opening the peritoneum much turbid, foul-smelling fluid was discharged. The gangrenous and ruptured appendix was removed and copious lavage of the peritoneal cavity with saline solution instituted. Appendix region alone drained with gauze. The uterus was found enlarged to about the fourth month of pregnancy. Wound partially closed with silkwormgut sutures. This patient was at once placed on her right side, with the head of the bed slightly elevated. The recovery has been slow. On the 28th patient had colicky abdominal pains, with a gush of clear fluid from the vagina. March 1, there were again intermittent pains simulating labor. Examination showed the os slightly dilated. March 20, patient expelled a dead fetus with the entire placental membranes. From this time on the convalescence was uneventful.

CASE VII.—*Gangrenous, Perforative Appendicitis; Diffuse Peritonitis; Pregnancy.*—A. P., white, female, ætat 23, born in Italy. Admitted February 27. Temperature 101.4°, pulse 144, respirations 36. Has had two children, one miscarriage, and at the present time is five months pregnant. For the past twelve days has had intermittent pain in the right lower abdomen, which became very severe forty-eight hours before admission, associated with vomiting. Abdomen distended and tender.

Operation (Stewart).—Incision through the right rectus. On opening the peritoneum much free purulent fluid escaped. Appendix perforated and intimately adherent to the colon; was ligated at the base and removed from the base toward the tip. Intestines much injected and in places coated with lymph, as was also the gravid uterus. Copious saline irrigation of peritoneal cavity. Appendix region alone drained with gauze. Patient at once placed on right side and head of the bed slightly elevated. Convalescence uneventful and without abortion.

Case VIII.—*Abscess of Upper Abdomen, possibly Pancreatic; Diffuse Peritonitis.*—J. D., colored, male, ætat 38, admitted March 1. Temperature $101^4/_5°$, pulse 96, respirations 28, leucocyte count 21,000.

Present illness began February 16 with pain in the lower right quadrant of the abdomen, diarrhœa and vomiting. After the first day vomiting ceased but diarrhœa continued. Forty-eight hours before admission pain localized itself in the upper abdomen and became very severe; abdomen much distended, tympanitic, rigid, especially tender in the epigastrium, and dull in the flanks.

Operation (Stewart).—Vertical incision through upper right rectus. On opening peritoneum an excess of cloudy, turbid fluid was seen among the injected intestines. At the upper part of the wound between the omentum and intestines were numerous adhesions, which had to be broken up before the edge of the liver was exposed. Liver and gall-bladder normal. In the upper abdomen, to the right of the median line, an area of discharging pus was found. This reached deeply into the abdomen and communicated with a second pus cavity in the region of the head of the pancreas. The exploration of this cavity produced a considerable hemorrhage, necessitating firm packing to control it. The upper peritoneal cavity was douched with hot saline solution. Patient reacted well. Profuse pus drainage. Patient improved nicely until March 18, when the pus cavity was much diminished in size but still continued deep. At 6.30 P.M. on this day patient complained of abdominal pain, followed by vomiting. In an hour the temperature had dropped to 97°, and the pulse risen to 140; extreme pallor of the mucous membranes; pulse very poor, and thready. He was again anæsthetized, and the original abdominal incision explored with the finger. A loculated collection of pus was found on each side of the drainage tract. These were evacuated. An incision was made in the lower abdomen and free blood-tinged fluid was found in this part of the peritoneum. A second incision was made in the right flank, and both these openings were drained with rubber and gauze. Patient's condition very serious. Reaction slow in spite of free stimulation. All wounds drained freely, the one in the right flank especially well, from which large amounts of necrotic tissue were discharged. Convalescence slowly established and the patient now seems in a fair way to recover, although he is still confined to bed.

Case IX.—*Diffuse Peritonitis,* cause unknown.—P. E., male, white, ætat 22, born in Italy. Admitted March 1. Temperature 100.8°, pulse 96, respirations 28, leucocyte count 13,500. Had a moderate attack of typhoid fever in the fall, for which he was treated in the Hospital, recovery good. For the past nine days he has complained of pain in the right lower quadrant of the abdomen, no vomiting, no chills. Bowels moved daily. On admission there was a rigid, tender, distended abdomen, with pain most marked in upper rectus region.

Operation (Stewart).—Incision through upper right rectus. On opening peritoneum a considerable amount of straw colored serum exudes. Gall bladder normal. Intestines deeply injected and covered in places with patches of lymph. Appendix slightly adherent at tip, showing areas of congestion but no perforation. It was removed. The small intestine was examined for several feet from cæcum. No perforations found. Mesenteric glands palpable and enlarged. Copious irrigation of the peritoneal cavity. No cause for the diffuse peritonitis found. Wound closed without drainage. Recovery uneventful.

Pathological Laboratory Report.—Chronic disease of the appendix, with some acute congestion but no perforation.

VOLVULUS OF GIANT SIGMOID COLON.

RECURRENT ATTACKS OF ACUTE OBSTRUCTION; RELIEF BY NEW METHOD.*

BY WILLIAM B. COLEY, M.D.,
OF NEW YORK.
AND
I. S. CHAFFEE, M.D.,
OF SHARON, CONN.

CASE HISTORY.—W. P., male, 55 years of age; had always been in good general health, with the exception of chronic constipation since childhood. In 1906 had an attack of complete obstipation, without any passage of gas or fecal matter, accompanied with great distention that resisted all efforts at relief by means of catharsis and rectal injection. On the eighth day, after repeated high enemas by the attending physician, Dr. Chaffee, the obstruction was relieved. The first movement contained large quantities of gas and liquid fecal matter.

The condition soon became normal and, aside from a marked tendency to constipation, which was relieved by cathartics, the patient had no trouble until June 28, 1908. His bowels did not move on that day, nor the succeeding days, and Dr. Chaffee was called in on the third day. The ordinary cathartics were given without result. Enemas high and low and of various kinds did not even bring away gas. Distention began to appear on the fourth day and gradually increased in severity. Temperature and pulse were normal. There was no pain, aside from the discomfort of the distention.

On July 6, the eighth day, I was called in consultation to see the patient. Physical examination at that time showed enormous distention of the abdomen, which seemed to be generally distributed throughout the entire abdomen; no asymmetry could be detected on inspection or palpation. No tenderness at any point. Temperature and pulse normal. I suggested a high injection of 8 ounces of glycerin with a pint of warm water, which was given without result. I saw the patient again on the following day.

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* Patient presented before the New York Surgical Society, April 14, 1909.

The condition remained unchanged, except that the distention had slightly increased and, with it, the discomfort. At no time had there been any nausea or vomiting. Pulse was below 90.

The fact that the patient had had a similar attack, lasting quite as long, two years before with final relief by means of medical measures, caused me to hesitate a little longer before advising operation. I stated that if no movement of the bowels were obtained the following day, I would advise immediate operation. The next day, July 8th, the temperature went up to 99.5° in the morning and pulse a little over 100; the distention had steadily increased and the discomfort had become very great, but there was as yet no nausea or vomiting. Learning his condition by telephone, I advised operation as soon as possible, and in the afternoon of July 8, accompanied by Dr. A. B. Ball, his old family physician and Dr. W. A. Downes, of New York, I took the first train to the place where he was living, ninety miles distant. We saw him at about six o'clock in the evening, and Dr. Chaffee stated that he had been getting steadily worse since morning. Temperature 100½°; pulse 120; respiration difficult, and the distention was the greatest that I have ever seen.

It was the opinion that the condition was probably one of obstruction from a malignant growth. It was evident that in his condition any general anæsthetic would be exceedingly dangerous, and immediate operation was decided on under cocaine anæsthesia. Under infiltration anæsthesia (one-fifth of one per cent. solution of cocaine), I made the ordinary colostomy incision in the left iliac region. On cutting through the peritoneum, an enormously distended sigmoid was found pressing up against the abdominal wall. Its exact size could not be ascertained, as no attempt was made to force the hand into the abdominal cavity. There were apparently no adhesions whatever. I sutured the sigmoid to the parietal peritoneum very carefully and then introduced a trocar of moderate size, through which escaped a very large quantity of gas which relieved the abdomen of at least three-fourths of its distention. This I believed sufficient to enable him to go through twenty-four hours with comparative comfort, allowing time for adhesions to form before making a permanent opening into the bowel. I therefore closed the trocar wound.

At the end of twenty-four hours I made a half-inch incision into the gut, through which escaped a good deal of gas and two or three quarts of liquid fecal matter, brown in color; no evidences of blood. After this the abdomen had become quite flat and palpation failed to reveal the presence of any tumor. Temperature on the following morning 98°; pulse, 80. In the afternoon it rose to 100.2°; pulse, 96.

On the following morning, July 10, the temperature was 98°, pulse 80; the patient had passed a very good night. During the next three days the temperature ranged between 98.5 and 101°. The dressing had to be frequently changed and was filled with profuse liquid fecal discharge.

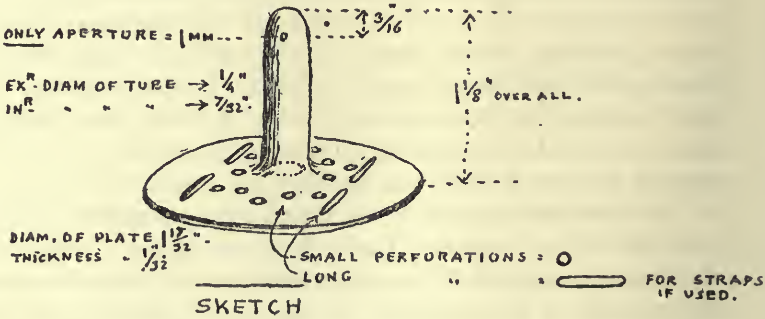
After July 14 the temperature remained perfectly normal. On July 19 he for the first time passed thick, dark-brown stool from the rectum, about two ounces in quantity along with considerable gas. In the afternoon of the same day he had a second movement of black, thick, unformed stool, with considerable flatus. During the succeeding days he continued to have two or three movements of the character just described, and the fecal matter coming through the colostomy wound gradually diminished in amount. July 22 and 23 he had three movements each day; the stools continued black in color, fluid or semi-fluid in consistence, rather small in quantity. July 24, he had three stools. July 25 he sat up in a chair for one-half hour, without fatigue; had three stools that day. By this time the wound had ceased to discharge fecal matter and was rapidly closing. July 26 he had six small stools. July 27, eight stools, all small, consisting of thickish brown material. A saline enema was given, and brought away little more than some fecal matter and a moderate amount of gas. July 28, five stools. July 29, six stools; patient sat up for two hours. July 30, had nine stools unchanged in character. The patient did not seem to get relief after these evacuations. The distention began to return and seemed to gradually increase; it never disappeared. August 2, eight stools. August 3, six stools. August 4, four stools. August 5, two stools; he was beginning to have some pain and discomfort in the abdomen. August 6, had five stools. August 7, seven stools, varying in consistence and in quantity; considerable flatus was discharged; the distention was gradually increasing in amount and becoming troublesome. Temperature remained 98.6°; pulse 56.

It was evident that his condition was gradually getting worse and that the obstruction was becoming more and more complete. Therefore, on August 8, I decided to again open the bowel at the site of the former incision, which was done without anæsthesia. On opening the sigmoid a very large amount of flatus was expelled and some fecal matter. The absence of any tumor—the abdomen being flat—and his good general condition led us to believe that our probable diagnosis of malignant disease was incorrect and that we had, instead, a greatly enlarged sigmoid which, when it became distended with gas, produced the condition of volvulus resulting in partial or complete obstruction. If this diagnosis were correct, it occurred to me that keeping a small tube in the opening of the abdomen would make it impossible for the gaseous distention to recur, and thus a recurrence of the condition of volvulus might be prevented. Therefore, after the first few days I removed the larger tube from the wound and inserted three-quarters of an inch of the tip of a No. 14 French rubber catheter, the end of which was attached by a safety pin.

The distention never recurred, and the following day, August 9, he had six movements. On August 10, he had none. The pain and discomfort left him; the abdomen was flat and apparently normal. On August 11 he had four stools of good size and semi-solid in consistence, no fecal matter coming through the wound. From that time on, his movements ranged between one and two a day, and were practically normal in character. There was no further discharge from the colostomy wound, except a small amount of liquid fecal matter which found its way through the small opening in the catheter.

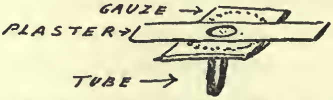
If our theory as to the causation of the volvulus was correct, it seemed necessary to continue the wearing of a tube in the old wound, but an opening in the tube that would permit the passage of air without fecal matter should be sufficient. After various modifications the tube shown in Figure 1 has been adopted as the most satisfactory. It consists of a silver tube, resembling the end of a No. 14 French catheter, connected with a circular silver flange about two inches in diameter, which rests upon the abdominal wall. Three-eights of an inch from the tip is a lateral opening only 1 mm. in diameter, which allows the escape of gas but does not permit the discharge of fecal matter. The tube has been worn up to the present time without any inconvenience to the patient. His general health has been perfect and there has been no recurrence or suspicion of a recurrence of the old trouble. I do not think, at the present time, that there can be any doubt that the condition we had to deal with was one of intestinal obstruction due to volvulus of a greatly enlarged sigmoid colon with an abnormally long mesentery, a condition which has been so well and so carefully described by Bloodgood in the ANNALS OF SURGERY for February, 1909.

FIG. 1.



SKETCH OF TUBE AS MODIFIED.

- PLATE WAS MADE ROUND TO ENSURE A MORE EVEN BEARING.
- STRAPS NOT USED - ADHESIVE PLASTER STRIP WITH HOLE IN CENTRE, PLACED OVER TUBE OPENING, USED INSTEAD THUS



A SMALL PERFORATED PIECE OF GAUZE WAS SLIPPED ALSO OVER TUBE TO INTERVENE BETWEEN PLATE AND WOUND.

At first there was strong reason to believe that the condition was one of malignant disease of the sigmoid.

Bloodgood states: "It is so unusual for a patient with acute intestinal obstruction to recover without operation, that such a history can be looked upon as evidence of a malignant tumor, but this more recent study of the rarer lesion—volvulus of the sigmoid colon—demonstrates that the same may occur here."

Our inability to find any tumor after the abdomen had become perectly flat and soft, together with the fact that the patient has remained in perfect health up to the present time, nearly ten months after the operation, makes it practically certain that the trouble was not cancer. There is, I believe, no condition other than volvulus of the sigmoid that could account for the two severe and several lighter attacks of intestinal obstruction that had been observed in the present case. Furthermore, the history of chronic constipation since infancy, with several attacks of partial obstruction, finally succeeded by the two attacks of complete obstruction lasting seven and nine days, respectively, without any of the symptoms of strangulation of the small intestine, almost definitely confirm the assumption that we had to deal with an obstruction of the large intestine. The immediate and complete relief of the symptoms following colostomy in the sigmoid, with the return of the symptoms after the opening in the bowel had healed and the perfect relief on the re-establishment of the opening in the sigmoid, though only sufficient to allow the passage of air, furnish, we believe, convincing evidence of a volvulus of the sigmoid. A giant sigmoid caused by long distention with an abnormally long mesentery gives us the necessary conditions for the formation of a volvulus. The symptoms are almost identical with those observed by Bloodgood, in whose case the condition was proved by laparotomy.

As regards the treatment, if this patient continues as well as during the last eleven months, it will be shown that in certain cases of this rare condition, perfect relief may be obtained by a less severe procedure than resection of the sigmoid.

That the condition is comparatively rare is shown by Bloodgood's statistics. Of 103 cases of intestinal obstruction observed at Johns Hopkins Hospital only 2 were due to volvulus of the sigmoid, and of 121 cases collected by Scudder at the Massachusetts General Hospital 9 were due to volvulus, yet only 2 of the sigmoid. Of these 9 cases all died.

For a more complete study of the condition, with reference to the literature, the reader is referred to Bloodgood's paper.

LARGE SLIDING HERNIAS OF THE SIGMOID.

WITH A DESCRIPTION OF AN OPERATION FOR THEIR RELIEF.*

BY LUCIUS W. HOTCHKISS, M.D.,

OF NEW YORK,

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SLIDING hernias of the sigmoid colon are of rare occurrence. They may be divided roughly into two varieties, which differ from each other principally in the arrangement of the peritoneal covering of the prolapsed intestine. In the first variety we have to deal with a small, incomplete, wide-necked, and direct left inguinal hernia. In this type of case, the sigmoid, largely uncovered by peritoneum save on its anterior surface, is thrust through the abdominal wall as a direct hernia, carrying with it a very small hernial sac situated upon its anterior surface near the internal ring. The posterior or uncovered portion of the bulging sigmoid may even be mistaken for the hernial sac and opened. This variety has its analogue in the cæcal hernia of the right side, and has been the subject of much discussion and study.

In the second variety there is generally a large, preformed hernial sac, into which other abdominal contents may have prolapsed, and into which the sigmoid with its mesentery has been dragged to a variable extent by the traction due to the increasing size of an old hernia. In this form the sigmoid is well covered with peritoneum, save at its mesenteric attachment. This variety is generally direct, complete, and completely irreducible. It occurs most often in elderly men, and is generally developed from simpler conditions in old hernias.

The diagnosis of either form of sliding sigmoid hernia before operation is always difficult and frequently impossible. Neither form is very liable to strangulation, by reason of the wide internal ring; but both forms are exceedingly intolerant to the pressure of a truss. This feature, indeed, is so characteristic as to lead to the suspicion of the existence of a sliding hernia when it occurs. In this paper a consideration of the second variety of sigmoid hernia will be undertaken, and a brief review of its clinical features, anatomy, and the operative difficulties attendant upon its relief discussed.

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* Read before the New York Surgical Society, March 24, 1909.

This form of hernia is but briefly mentioned in most of the text-books upon surgery, and it is necessary to resort to a special treatise on hernia to find any considerable description of its anatomy and surgical repair. These large sigmoid hernias are always irreducible because the sigmoid mesocolon has been dragged into and made to form an essential part of the posterior wall of the hernial sac, and it is not always easy to secure reduction of this prolapsed adherent gut without interfering with its nutrition. It is evident, therefore, that any operation for the radical cure of such a sliding hernia must be based primarily upon some safe and effectual method of reducing the prolapsed sigmoid without interfering with or destroying its blood supply. In addition to the difficulties of effecting a complete reduction of the sliding intestine in these cases, the surgeon has also to deal with other conditions, which, separately or together, may defeat his best laid plans. In the first place the patients are generally old; their tissues upon which he has to rely to form barriers against an early recurrence are often fatty, feeble and atrophied; and in addition, an enfeebled general condition may sometimes be present which renders repair slow, infection easy, and the result doubtful.

To follow out the principle which is a fundamental one in the repair of all hernias, viz., the high ligation of the sac flush with the parietal peritoneum, is obviously impossible in these cases of sliding sigmoid hernias, in which a part of the contents of the hernial sac are irreducible. Even suture of the neck of the sac after reduction of the gut may be more or less imperfect, if the bladder prolapses to any considerable extent; and only the greatest care will enable us to overcome these difficulties and make a repair that is at all effectual. In June, 1905, I first operated upon a case of large sigmoid hernia, and the problem which presented itself for the first time had to be solved at the moment or the patient returned to bed with his condition unimproved.

The patient, a man about 60, had been referred to Roosevelt Hospital by Dr. Delphey, suffering from a large old left inguinal hernia, which had grown more and more troublesome in later years, until he could no longer work. As he could tolerate no form of truss which would furnish him support, he finally submitted to operation as a last resort. His general condition was not favorable, as he was markedly alcoholic and not easily restrained after the operation.

On June 3, 1905, under ether anæsthesia, the hernia was cut down upon by the usual oblique incision, and not until the sac was opened was the diagnosis of sliding hernia of the sigmoid made. The sac was large and reached well down into the scrotum. It contained omentum, and small and large intestine. All the contents were easily reducible through the wide internal ring, save a long piece of the sigmoid colon which was adherent by a short mesocolon to the posterior wall of the sac, to the extent of about four inches. Under these conditions it was, of course, impossible to close off the neck of the sac by any of the usual means of ligation or suture. The mesosigmoid, being short, could not be tied off so as to permit the reduction of the gut without danger of causing necrosis. In order to overcome this difficulty, I devised a measure which I had never seen described but which served so well in this and other similar cases which I have had, that it seems proper to report it as a method which is safe, easy, and effectual, in meeting the first of the indications in these rare and troublesome cases. The operation consists briefly, in the construction of an elongated mesocolon from the tissues of the hernial sac wall in such manner as to permit of the easy and perfect reduction of the gut into the abdominal cavity, and not to interfere with the suture of the internal opening of the sac. The steps of the operation are as follows:

Having freed the sac from the cord to its full extent, the sac is opened anteriorly and its reducible contents replaced within the abdomen, and held there by a gauze pad. The incision in the sac is then prolonged upward to the internal ring and downward nearly to the lowermost point of attachment of the mesosigmoid on its posterior wall, which permits easy eversion of the sac wall. Grasping the adherent sigmoid and pulling it gently forward, it will be found that the peritoneum of the split hernial sac will become everted in such a manner as easily to form a new and elongated mesentery for the sigmoid, with its smooth peritoneal surfaces turned outward to form its free surface, and its outer or non-peritoneal surfaces falling in contact. Suturing the edges of this new mesentery together permits its elongation to an extent sufficient to allow the perfect reduction of the sigmoid into the abdominal cavity.

When this step has been accomplished the somewhat irregular-shaped opening into the abdominal cavity may be sutured tightly by a purse-string suture introduced from within, or by any other form of suture which seems best to meet the case.

The first case operated upon by this method was reported well after about three years, and, as far as I know, has had no return of his trouble, although he has now a hernia on the other side.

A second case operated upon in Bellevue Hospital December 8, 1906, was also easily and effectually repaired by this method. The patient, a man of 56, had a large irreducible sigmoid hernia in which a truss could not be worn. The sigmoid mesocolon in this case also formed a part of the posterior wall of the hernial sac; and this was elongated and the gut easily reduced by the plastic method described, and the internal ring closed by purse-string suture. The further steps followed the lines of a regular Bassini operation with overlapping of the edges of the external oblique aponeurosis as an additional barrier.

A third case, an elderly male patient, was operated upon in Bellevue Hospital January 19, 1907. He also had a large direct sliding hernia of the sigmoid with a prolapsed bladder. The sigmoid was easily reduced and repaired by the same method. A few weeks ago a beginning sigmoid hernia of the same type was operated upon. And as this is going to the printer two more cases have been operated upon on the same day at Bellevue Hospital. In all of them the reduction was easy and perfect and the closure of neck of the sac by purse-string suture easily done.

As the writer has made no extended search of the literature to determine whether a similar method has been described and used in sigmoid hernias he can of course make no claim to originality, but desires to offer this method of operation as one quite reliable to effect the purpose for which it was designed: the easy, safe, and complete reduction of a prolapsed and adherent sigmoid.

THE FAT APPENDIX.

BY HOWARD A. KELLY, M.D.,

OF BALTIMORE, MD.,

Professor of Gynæcologic Surgery in Johns Hopkins University.

The difficulties sometimes presented in removing a fat vermiform appendix have not, I think, had sufficient attention. Fat is always a complication in surgical work; and, in addition to the purely technical obstacles, stout patients are difficult to anæsthetize, as they stand anæsthesia worse than others; if kept long with the pelvis elevated, their hearts are liable to run away, and death occurs far more readily than in those who are not so burdened.

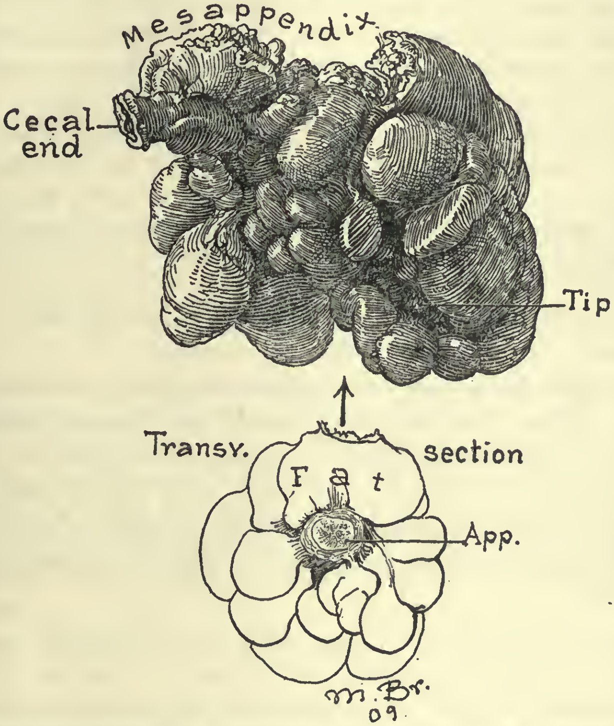
From a clinical standpoint, fat is a condition allied to multiple tumors; it chokes the tissues and resembles a papilloma which fills up all interstices of the abdomen, making it difficult to discriminate between the organs. I recall vividly a patient I saw in Wilkes-Barre, Pa., with Dr. Geo. Guthrie many years ago, who had an enormous amount of fat in the abdomen and acquired an extensive ascites. In order to tap the abdomen, Dr. Guthrie had had to use a trocar which was so big that it looked like a sword. In cases like this there is always a thin point at the umbilicus which I utilize, where one can make an incision and introduce the arm to explore the abdomen.

One of the great difficulties in operating upon fat women is that of exposing the parts within. The fat is so abundant and crowds out over the field of operation so continually as to be a constant source of distressing annoyance.

In operating upon the fat vermiform appendix, these difficulties may be most pronounced. I published a picture of such a case in my work on "The Vermiform Appendix and its Diseases," opposite p. 140.

Only recently I saw a case (see Fig. 1) in Salisbury, N. C., with Dr. John Whitehead. The patient's abdomen looked large enough to contain a seven month's fœtus, so I expected to find a large fat omentum. Deliberating the propriety of removing it as I have done in similar cases, I opened the abdomen and the fat was not so much in the omentum as in the epiploa and throughout other parts of the abdomen. The appendix was hard to find, so it was necessary to carry the incision up to the umbilicus. After bringing up the cæcum and the terminal part of the ileum, a mass of fat about two inches long was picked up and recognized by its connection with the bowel to be the appendix. The appendix itself could hardly be seen except in little islets here and there through the fat. Drawn forward, with a view to tying off the mesappendix, its structures began to tear and with the tearing to bleed freely. It was necessary,

Fig. 1.



The figure shows one of these appendices so often met with, described in the text. The upper figure and the lower outline, with the appendix in the middle, show how completely the organ is lost in the embedding masses of fat. Great care is necessary in the removal to avoid tearing the vessels, which retract and are difficult to find.

therefore, with extreme care to retract the right side of the incision over the appendix, to pack off the bowel on all sides, leaving the appendix almost untouched *in situ,* and with the greatest gentleness to pass sutures under mesappendix at the highest point up near the ileum. Even with the gentlest handling there was some tearing of the tissue and further bleeding, so that satisfactory ligation of the vessels in the mesappendix was only conducted with considerable risk of their tearing and retracting under the ileum. After tying off the mesappendix it is often necessary to get rid of the fat which crowds around the base of the appendix in order to expose it for ligation of the appendix itself. The organ in this case was clamped and thoroughly cauterized so as to sterilize and seal the proximal end, when it was inverted by pushing it in and drawing up a purse-string suture. Over this two mattress sutures were placed, making the inversion a little more complete.

Let me emphasize the following points in cases where excessive fat is apt to complicate matters:

It hides the organs; the fatty mesappendix is friable and liable to tear; and bleeding vessels may retract under the ileum and may even make it necessary to free the cæcum and the ileum in order to tie them at a higher point. To overcome these difficulties, let a larger incision be made, pick up the organ with the utmost gentleness, and always handle it *in situ.*

TRANSACTIONS

OF THE

NEW YORK SURGICAL SOCIETY.

Stated Meeting, March 24, 1909.

The Vice-President, Dr. Ellsworth Eliot, Jr. in the Chair.

REMOVAL OF MULTIPLE TUBERCULOUS FOCI, INCLUDING RESECTION OF ANKLE JOINT AND OF THE SEVENTH COSTOSTERNAL ARTICULATION: DOUBLE CASTRATION AND REMOVAL OF THE SEMINAL VESICLES.

Dr. Walton Martin presented a man 23 years old, who was admitted to the Roosevelt Hospital, in the service of Dr. Blake, on March 12, 1907. The patient's complaint at that time was swelling and pain in the right ankle. He had been ill for about a year, and during the last four months had been unable to walk without crutches. The ankle had been immobilized, but this gave him no relief. He had lost 20 pounds in weight.

On examination, the right ankle was found much swollen and very tender. Fluctuation was evident in front of the malleoli. The muscle of the leg showed atrophy. On the following day there was a discharge of cheesy pus through the skin in front of the inner malleolus.

On March 18, 1907, the astragalus, the synovia of the ankle joint and the ends of the tibia and fibula were removed through a lateral incision. Under the microscope, these showed extensive tuberculosis.

On April 15 of the same year the patient complained of pain in the anterior chest, and called attention to a small swelling in the region of the seventh costosternal articulation. The following day the seventh cartilage and the costosternal articulation were resected. In June the patient left the hospital, much improved. He was sent to Liberty, N. Y., where he remained for three months, gaining 20 pounds in weight.

He returned to New York, and during the winter of 1908 he remained in good health. The following May, however, he began to complain of pain in the left testicle, and noticed an indurated mass at the bottom of the scrotum. He was again admitted to Roosevelt Hospital, and the left testis and a considerable portion of the vas deferens were removed. They showed extensive tuberculosis. Following this he was sent to the Adirondacks, where he gained 18 pounds in weight during the summer. The following November he returned to the city and resumed his work. In January, 1909, his right testis became very painful, and on examination it was found to be swollen and tender and the overlying skin was reddened. Rectal examination showed enlargement of both seminal vesicles. He was readmitted to the hospital, and on January 11 the right testis and the seminal vesicles were removed. The patient now weighed 153 pounds, and was free from pain. When he entered the hospital in March, 1907, he weighed 128 pounds.

Dr. Howard Lilienthal said it had been his experience, in every case of tuberculosis of the testis, to find a nodular and apparently tuberculous condition of the corresponding seminal vesicle, and he had come to the conclusion that the seminal vesicle was frequently first involved, the disease then extending to the testis, very much the same as with a gonorrhœal infection.

In the treatment of these cases, Dr. Lilienthal suggested the use of tuberculin, which he considered of enormous value in surgical tuberculosis, combined, with the excision of the diseased part.

Dr. George Woolsey said he had a patient now convalescing from an operation on a tubercular testis where there was no involvement of the seminal vesicle, and he could recall one or two other similar ones.

Dr. John A. Hartwell said he had seen a number of cases of tubercular testis in which the seminal vesicle was apparently not involved and in which the vas showed no evidence of involvement.

Dr. Lilienthal said that the vas was certainly not always involved. In a case which he saw recently the vas was perfectly normal in feel, and in that particular case Dr. Moschcowitz had made a resection of the testis and had limited himself to a removal of the part of the testis actually diseased. Had the vas been involved, he would certainly not have left it behind. It was quite plausible in some of these cases, the speaker said, that the seminal vesicle and testis might be involved, leaving the vas intact, in spite of the fact that the infection was transmitted through it, just as a healthy ureter might transmit a renal infection.

Dr. Eliot agreed with Dr. Woolsey that it was not the invariable rule in these cases to find the seminal vesicle involved, particularly in the acute type. In such cases there was frequently no evidence of involvement of the seminal vesicles.

HARELIP: FURTHER IMPROVED RETENTION APPARATUS.

Dr. Theodore Dunham said that about four years ago, at a meeting of this Society, he showed an improved retention apparatus, which was subsequently described and illustrated in the Annals of Surgery, October, 1905. In the application of that method, the materials required were two narrow strips of chiffon, a strand of silkworm gut, and some flexible collodion. One end of a strip of the chiffon was pasted to the cheek with collodion, beginning with the end of the strip out on the cheek and pasting it as far inward as the angle of the mouth. The silkworm gut was then laid over the pasted chiffon at the point where the pasting was stopped, and the free part of the strip was folded back and pasted in that position. The strand of silkworm gut was thus secured on each side, and it was so smooth that it slid easily through the bight of the chiffon. When the collodion was dry, which would be in a very few minutes, the ends of the silkworm gut were tied together below. The degree of tension could be gauged to a nicety. After the knot had been tied, one of the loose ends was thrown around the upper half of the silkworm gut loop and tied to the other loose end. This drew the upper half down from the nostrils and the lower half up from the margin of the lip.

Recently, Dr. Dunham said, he had further modified and improved this method by introducing bits of rubber tubing underneath the chiffon strips and passing the retaining suture through their lumina. By this modification, the tension on the cheeks could be more properly adjusted, and it prevented the fabric from puckering. It also had the advantage of elevating the threads from the skin, thus carrying them a little forwards, so that they did not press upon the lips. Instead of silkworm gut he now uses a linen thread.

In connection with this method, Dr. Dunham showed two patients upon whom he had employed it with excellent cosmetic results. The apparatus should be kept on for about three weeks.

Dr. Alfred S. Taylor said he was rather inclined to favor a retention apparatus that would not pass across the wound. A very simple method that he had used was to take a narrow strip of adhesive plaster passing from one cheek obliquely over the bridge of the nose to the forehead on the opposite side. A similar strip was carried from the other cheek. By this means the wound was relieved of all tension, and even during the child's crying spells there was no tension on the sutures, which were always open to inspection. The apparatus was extremely simple and could be kept clean. If the plaster showed any tendency to "creep" it could readily be replaced without danger to the wound.

Dr. Howard Lilienthal said he had employed Dr. Dunham's method several times since its demonstration in 1905, and he had been very much pleased with it. He had never had any trouble on account of the apparatus passing over the line of union, although he admitted that Dr. Taylor's objection to that feature was well taken. The strips of chiffon cloth he had found superior to adhesive plaster because, as Dr. Dunham had said in his published paper, they would not "creep." Instead of the ordinary gun-cotton and ether collodion, he preferred to use the acetone-celluloid collodion, or "new skin," as it was popularly known. It was much stronger than the former, and adhered better.

Dr. Eliot asked whether Dr. Dunham did not think that an incision made obliquely to the long axis of the lip did not give a better result than where it was made at right angles to the lip? Personally, it had been his custom to follow as far as possible the Mirault method, having the incision pass obliquely through the lip, thereby trying to avoid the notch which was apt to follow the right-angled incision.

THYROGLOSSAL CYST.

Dr. George Woolsey presented a woman, 25 years old, who had cerebrospinal meningitis four years before. Upon her recovery it was noticed that she had a swelling below the jaw. This was painless, and slowly increased in size. Six weeks before her admission to the hospital she began to have some difficulty in speaking, mastication and deglutition. Upon examination it was found that the swelling had extended to the floor of the mouth and that it was pushing the tongue upwards. In appearance, it was a round cystic swelling about the size of a small egg, and underneath the chin there was a tumor the size of a small apple. Both of these swellings were cystic in character, fluctuating on pressure, and showing no evidence of inflammation or tenderness.

Operation: On December 3, 1908, a two-inch median incision was made from the chin to the hyoid bone, disclosing a thin-walled cyst filled with serous and curd-like material. Upon dissecting out the cyst it was found to extend upwards, and between the muscles of the tongue was a pedicle which represented the thyroglossal duct. The removed portion of the cyst was not patent on macroscopic examination.

Prior to the operation, the patient was given six minims of Magendie's solution, and as a preliminary step the tongue was held forward by means of a suture. The patient proved very difficult to anæsthetize. Immediately following the operation the respirations became labored and slow, gradually decreasing from sixteen to one per minute, and the tongue was very much swollen. She was cyanotic, and the pulse was very feeble. There was an apparent œdema of the glottis, and after intubation had been unsuccessfully tried a low tracheotomy was done by the house surgeon. The patient was placed in a tent, and for twelve hours she was given oxygen, warmed and moistened. Her respiration gradually improved, as well as her ability to swallow, and the further recovery of the patient was uneventful.

Upon pathological examination, the cyst proved to be connected with the thyroglossal duct.

Dr. Eliot said he had had one case of thyroglossal cyst, where, in order to effect its complete removal, he had to divide the hyoid bone. This was afterwards brought together and sutured with very satisfactory results.

Dr. Lilienthal said he had had a number of cases where, in order to dissect out the fistulous tract, he had found it necessary to cut away part of the hyoid bone, but he had never divided it. In order to leave a more sightly scar, he advised an incision made transversely in one of the folds of the neck. Sagittal scars of the neck were apt to spread and become unsightly, whereas with a cross cut we could get a much neater line of union.

SUPPURATIVE ARTHRITIS OF THE KNEE TREATED BY THE MAYO METHOD.

Dr. Charles N. Dowd presented a boy of 6 years, who was brought to St. Mary's Hospital last November, having punctured his knee joint with a needle and having a suppurative arthritis. He developed extreme septicæmia with a temperature of 105.5 degrees, and on opening the knee-joint it was considered best to make the transverse incision carried through the ligamentum patellæ and drain it in this way at a somewhat earlier period than is usually done. The crucial ligaments were therefore divided, the leg flexed at an acute angle, a plaster of Paris bandage was adjusted with a large window over the knee joint, and the leg was elevated by a sling. The patella flap was not sewed back. Abundant gauze dressing was applied to the exposed portions of the knee joint. He did not suffer after the operation as much as patients ordinarily do with suppurative knee joint.

Sixteen days later the plaster was taken off and replaced in a more moderate degree of flexion, and a few days later it was again removed and the leg extended.

There was a slow point of healing at the lower part of the incision, but the child now had a very useful knee joint with about 30 degrees of motion and a strong probability of obtaining more.

The transverse incision for knee joint drainage had usually been made with the expectation of a future resection,—and such resections had frequently been necessary in order to straighten the leg.

The case was shown, Dr. Dowd said, to illustrate the possibilities of joint motion and good general result after the treatment of suppurative arthritis by making a transverse incision and putting the leg in extreme flexion.

Dr. F. Kammerer said that in two of his cases where the knee was kept in a flexed position for two weeks, he was unable to bring it back into position, and had to do a resection. Both of his cases were in adults.

Dr. Charles H. Peck said that in dealing with this condition in adults, the transverse incision with division of the crucial ligaments was hardly justifiable except in cases where suppuration had been present a long time, with consequent disorganization of the joint or where the infection was very severe from the onset. It seemed to him that in adults a resection would finally be necessary in almost every instance after the suppuration had subsided. In the original report of Mayo's operation, the crucial ligaments were not divided. If the suppuration could be controlled without division of the crucial ligaments, he thought that an attempt should be made to restore motion, especially in children,—but in adults, and particularly in advanced cases, this was usually impracticable. In the cases that had come under his own observation there had been a good deal of contraction of the flexor muscles, and it would have been very difficult if not impossible to straighten them without resection.

Dr. Eliot said that in children, motion was more apt to take place after joint suppuration than in adults, irrespective of the method of treatment. That fact had often been demonstrated in connection with the elbow joint, and less frequently with the knee. He could recall a number of such cases in children where in adults stiffness would have been the rule. He asked whether in the case shown by Dr. Dowd motion was increasing or decreasing, and called attention to the fact that handling the joint seemed to give rise to considerable pain.

Dr. Dowd, in closing, said the Mayos had done a good many of these operations without division of the crucial ligaments. In the case he had shown, Dr. Dowd said that in spite of the fact that the operation was still of very recent date and that the boy had just gone through a severe attack of diphtheria which had retarded his progress, he thought that the motion in the affected joint was increasing. The treatment of this condition in children and in adults was on an entirely different basis, and the former were much more likely to get a return of motion than the latter. In looking over the cases collected a few years ago by Dr. Peck of this Society, the speaker said he had noticed that a very large proportion had been children, and that being the case, we had here a method of treatment which might restore them with a fair degree of motion.

SPLENECTOMY FOR SPLENIC ANÆMIA.

Dr. F. Kammerer presented a man, 23 years of age, who was admitted to the German Hospital in November, 1908. His family history was negative, excepting for the fact that his father died some years ago from heart disease, and at the autopsy a very large spleen was found. There was no history of nervous ailments in the patient's family, and during his childhood he had never been sick.

Seven years ago he first had occasional pains in the left lumbar region, and soon afterwards he noticed a swelling on the left side. Four years ago he was exempted from military duty on account of a tumor of the spleen. Until four weeks prior to his admission to the hospital, however, he was able to follow his occupation as clerk. At that time the pain in the back had increased, and severe headache had set in,—he was weak, and on several occasions felt dizzy and fell to the ground, without losing consciousness. During the five days prior to admission he vomited incessantly. He had been jaundiced for the past four weeks. He gave no history of malaria, and no plasmodia were ever found in the blood.

The patient was treated for two months in the medical wards of the hospital by Dr. Stadtmüller, to whom Dr. Kammerer is indebted for the following data: On admission, his temperature was 103.6; pulse, 120. The patient was well developed; his complexion was pale, but he was distinctly jaundiced. The apex of the right lung showed slight changes. The heart sounds were normal. The abdomen was soft, and not distended or sensitive to touch. There was no free fluid in the abdominal cavity, although two weeks before a small amount of ascites was said to have been present. The liver was somewhat enlarged. The urine contained considerable albumin, with hyaline and granular casts, but no urobilin. The blood count, on admission, showed red blood cells, 2,180,000; white blood cells, 5,750; hæmoglobin, 40 per cent. The lowest blood count during two months treatment in the medical wards was red blood cells, 1,880,000; white blood cells, 4,050; hæmoglobin, 35 per cent.

During the first few weeks after admission and the last few weeks before operation the patient had fever of a remittent type, his temperature rising to 103–104 degrees every evening. During the interval, for about a fortnight, his temperature was normal, but gradually, with a renewed rise, he became weak and lost flesh rapidly. His condition finally became critical, and on December 16 he consented to operation.

A Z-shaped incision was made in the epigastrium, the vertical portion of which was placed at the outer border of the left rectus. On opening the abdominal cavity, dense, fibrous adhesions were found between the upper pole of the spleen and the posterior portions of the diaphragm. With some difficulty, these were torn without injuring the capsule of the spleen, and with very little hemorrhage. The entire organ was then lifted from the abdomen and its pedicle ligated in several portions. The incision was closed without drainage.

The patient's condition was very encouraging for the first ten days. His temperature dropped to normal on the second day after operation, and did not rise again. His appetite immediately improved, and his jaundice disappeared. On the tenth day Dr. Kammerer was hastily summoned, as the patient had had a fit. Dr. Stetten, who saw the patient at the time, found a complete separation of the sutured incision from angle to angle, with protrusion of much intestine. The latter was replaced within the abdominal cavity, and the incision was completely closed with through-and-through silkworm sutures, which did not separate again. Three days later the patient had a second convulsion which began on the left side of the face, soon extending over the whole body. He was unconscious for four hours. He had violent clonic spasms, involving the entire body, which were partially controlled by chloroform. During this attack he was deeply cyanotic, with an almost imperceptible pulse.

On the following day the patient was very much excited, and finally became delirious, necessitating isolation. This condition lasted four days more. About two weeks later he had two further attacks of clonic spasms, lasting several hours. These were again followed by a state of mental derangement of three days' duration. There were no further interruptions in the patient's convalescence, and now, about three months after the operation, he had gained thirty pounds in weight, his jaundice had completely disappeared, and his urine is free from albumin and casts. His blood count, taken a few days ago, showed red blood cells, 5,220,000; white blood cells, 11,000; hæmoglobin, 90 per cent.

Considering that the patient has never before the operation been the subject of epileptic attacks, the question of a possible connection between the splenectomy and the convulsions was an interesting one. Dr. Stadtmüller had informed him that in a rather careful search of the literature he had been able to find only one case in which anything similar was reported; *i.e.,* tetanic attacks which appeared twelve hours after splenectomy and continued at intervals for five days. He had found no case, however, which was followed by epileptiform convulsions, with loss of consciousness. The possibility of these attacks being uræmic in character was also considered, but rejected.

Dr. Lilienthal said he had had a case similar to the one reported by Dr. Kammerer. The patient was a girl of sixteen whose abdomen had been enlarged for quite a long time. She then had a fall, and immediately afterwards became much shocked. She recovered from this and, three or four days later, when Dr. Lilienthal saw her, the abdomen was enormously distended. In addition to the presence of fluid in the abdomen, an enlarged spleen could be made out. In spite of the fact that the patient was extremely anæmic, operative interference was advised.

The first incision brought an enormous gush of blood, old and fresh clots, and bloody serum. There were adhesions between the omentum and spleen, and upon freeing these, which was done rather easily, there was a terrific gush of blood. Fortunately, the spleen could be lifted out without difficulty, and the hemorrhage was at once controlled by tying off the pedicle. The splenectomy was then completed. The girl made an excellent recovery, and had remained well. She had lost her waxy complexion and the blood count was now normal.

Dr. Dowd reported the recent case of Banti's disease for whom he had assisted a colleague to do a splenectomy. The patient had extreme ascites, anæmia and jaundice; the liver was shrunken to about one-sixth of its normal size, and the spleen was much enlarged and adherent to the diaphragm. The patient was running a high temperature and the case did not appear to be a promising one for operation. The spleen was removed, and the woman made a good recovery from the operation itself, and now, a few days after the operation, she seems better than she has for weeks. The final outcome of the case, however, can hardly be expected to be good.

LARGE SLIDING HERNIAS OF THE SIGMOID.

Dr. Lucius W. Hotchkiss read a paper with the above title, for which see page 470.

Dr. William B. Coley said he agreed with Dr. Hotchkiss that this condition was one of considerable rarity, his own experience having been limited to perhaps half a dozen cases. He had seen a larger number of cases of sliding hernia of the cæcum, which, as well as the sigmoid cases, he had treated by freeing the posterior wall of the sac as far up as he dared without cutting off the circulation, and then pushing it back into the abdomen. In dealing with this condition of sliding hernia of the sigmoid, Dr. Thomas Fiaschi of Sydney, Australia, in an article in the *Australian Medical Gazette,* had brought the sigmoid up to the anterior abdominal wall, where it was retained by suture. The speaker said he thought the method described by Dr. Hotchkiss was an excellent one.

Dr. Lilienthal said he recently saw a case of sliding hernia of the sigmoid, with the attachment of the mesocolon down in the sac, and in that instance he did not see how it would have been possible to raise it up. It was an enormous hernia in a fat man whose general condition was bad. In that case, replacement seemed absolutely impossible, and nothing was attempted. In other cases, Dr. Lilienthal said that he had succeeded in inverting the sac, taking off the redundant portion, and then inserting purse-string sutures. In the first case referred to, if the patient had been in better condition, he would have been inclined to resect part of the sigmoid and put the rest back.

Dr. Woolsey said the method of treating these cases described by Dr. Hotchkiss seemed to be perfectly plain and feasible. Personally, he could recall only two cases of hernia of this variety; in both instances he succeeded in getting them back, but only after trimming the sac.

SEPTIC OSTEOMYELITIS OF THE CLAVICLE.

Dr. Lucius W. Hotchkiss presented a clavicle removed from a boy of ten years who was admitted to Bellevue Hospital on March 21, 1909. The history he gave was that about a week before admission the left shoulder suddenly became swollen and painful. He was first treated for rheumatism, but as the swelling increased and the pain was not relieved, he was sent to the hospital.

Upon admission, the region of the left shoulder and upper part of the left pectoral region was red, tense and swollen, and very tender. Movements of the shoulder caused great pain. Operation, March 22: Manipulation, under ether, caused no crackling in the shoulder. An incision over the pectoralis major revealed deep infiltration of the skin, connective tissue and muscle, and evacuated considerable pus. The sharp edge of the clavicle was felt while thrusting the finger into this wound, and an incision over the bone showed that the entire bone was bare and rough; it was separated from its periosteum and lying loosely adherent to the same in a pool of pus. The incision was enlarged, and the entire bone, with the exception of the epiphyses, was easily lifted out of its bed with the aid of a periosteal elevator and forceps. No other bone in the body was apparently affected.

Dr. Dunham said that a number of years ago, while he was House Surgeon at Bellevue Hospital, he had a case very similar to the one reported by Dr. Hotchkiss. The patient was a young man who had an abscess on the left upper chest. Upon incision, pus was found, and the entire clavicle was denuded of periosteum. The clavicle was removed. Subsequently, the patient developed a suppurative periosteitis of the lower part of the tibia, which was incised. Later, and while apparently convalescing, he developed a pocket of pus in one thigh, which was traced to a periosteitis of the femur.

Stated Meeting, April 14, 1909.

The President, Dr. Joseph A. Blake, in the Chair.

HARELIP.

Dr. Theodore Dunham presented a baby who was born with a complete cleft palate and a harelip. The premaxillary portion of the alveolar process was tilted forward and toward the sound side. The baby had been unable to take the breast and had been artificially fed from birth. On April 9, 1909, when she was seventeen days old, Dr. Dunham operated on the alveolar process and the lip. He cut through the alveolar process just forward of the site for eruption of the canine, and carried this incision back in the hard palate. By means of this incision and a certain degree of force he cracked the bone and turned the premaxillary alveolar process into place, and retained it there by a suture passing through the bone. The gap in the lip was closed by virtually the Mirault incision.

Directly after operation he applied the retention device (which he had described at the previous meeting of this Society) to relieve tension on the lip sutures. It was now five days since the operation. The day following the operation there was a trifling rise of temperature, but since then it had been virtually normal and the baby had never had a disturbing symptom. The stitches and retention device had not been disturbed since the child left the operating room.

POPLITEAL ANEURISM TREATED BY MATAS'S RECONSTRUCTIVE METHOD.

Dr. Frank W. Murray presented a negro, 37 years old, who was admitted to the New York Hospital on July 6, 1908. He had been a warehouse porter for years and was accustomed to lifting heavy boxes and barrels, but he denied any history of direct trauma. Twelve years ago he had a hard chancre, but asserts that secondary manifestations were wanting. In December, 1907, he noticed at the end of the day's work that the left leg and foot were slightly swollen, but after a night's rest the swelling subsided. Later on, the foot and leg began to swell steadily, and by March he was unable to wear a shoe. Six weeks rest in bed caused a considerable diminution of the swelling, but the left leg and foot were always larger than the right. On returning to work the swelling again increased and pain began in the left popliteal region. The pain at first was rather mild, at times shooting down the calf of the leg into the sole of the foot, and in a few weeks it became much worse. Early in June, owing to the pain and the swelling of the foot and leg, he was compelled to give up his work, and after a month's rest in bed, the leg being still swollen and useless, he came to the hospital for surgical treatment.

Examination on admission revealed the left leg from the knee downward much swollen and œdematous, and almost twice the size of its fellow. It was somewhat cold, not painful on pressure, and there was no loss of sensation. On attempting to walk, the patient complained of severe pain in the popliteal space, the pain shooting downward to the sole of the foot. The popliteal space was filled by a firm and somewhat rounded tumor, with pulsation of an expansile character, and with the stethescope a cystolic bruit could be heard. Pulsation in the posterior tibial artery was absent, but there was faint pulsation in the dorsalis pedis.

Operation, July 8. Gas and ether; the patient prone. Hæmostasis by means of an Esmarch bandage applied from the toes to the upper third of the thigh. Over the middle of the popliteal space a four-inch longitudinal incision was carried down through the skin and the fascia and the aneurismal sac was exposed. The popliteal vein and the internal popliteal nerve lay over the outer portion of the sac, and were freed by blunt dissection and were retracted outward. The sac was incised in the median line, and some fibrin and blood clots, together with a small amount of fluid blood, were sponged out. The sac was three inches in length and was formed at the expense of the posterior and internal walls of the artery, and was of the so-called fusiform variety. The incision in the sac wall was lengthened until the proximal and distal openings of the artery could be seen, and then a flexible catheter—about No. 15 French—was inserted into both proximal and distal openings, the catheter lying on the anterior wall of the sac. Twelve interrupted Lembert sutures of No. 0 chromic gut were introduced over the catheter and the upper and lower four sutures were tied. On withdrawing the catheter the middle four sutures were then tied, thus forming a new lumen for the popliteal artery. A layer of continuous sutures of No. 0 chromic gut was applied over the first and the remainder of the sac wall was united by four interrupted No. 0 chromic gut sutures. On removing the tourniquet no hemorrhage occurred in the sac and pulsation could be felt in the lumen of the newly formed artery. The wound was closed with silk sutures, dry sterile dressing applied and the leg placed in a Volkmann's splint.

The postoperative history was uneventful. The wound healed by first intention; sutures were out on the eighth day, and a plaster splint, reaching from the ankle to the middle third of the thigh, was applied on the ninth day. Thirteen days after the operation the patient left the hospital, walking with crutches. During the following two months a new splint was twice-reapplied, and in October was discarded permanently. The patient avers that for some time after the operation there was loss of sensation on the outer side of the foot and in the skin around the large toe, and that the toe-nail shrivelled up and dropped off. As loss of sensation was wanting in these regions before the operation it is likely that it was due to the pressure on the nerve by the retractor at the time of the operation. The present condition of the patient is satisfactory and there are no signs of recurrence of the aneurism. Pulsation of the posterior tibial and dorsalis pedis is wanting. The leg, while slightly larger than its fellow, is perfectly useful and the patient is able to do his work as porter on a sleeping-car. Since the operation he has been on specific treatment, on alternating months, and this treatment will be continued for a year longer.

EXOPHTHALMIC GOITRE—OPERATION IN THREE STAGES; LOCAL ANÆSTHESIA.

Dr. Clarence A. McWilliams presented a girl of 13 who was admitted to the Yonkers Hospital in January, 1908, with symptoms typical of marked chorea. Three weeks later Graves's disease began to develop, and became pronounced. Her pulse ranged from 130 to 140, the eyes protruded, the thyroid gland was enlarged and tender, and her nervousness was excessive. Various medical measures were tried, and three months after her admission the Rogers and Beebe serum was used, five injections in all being given, but no beneficial effects were noted. This, however, was scarcely a fair test as to the efficacy of the serum, as the number of injections was too few.

When Dr. McWilliams first saw the patient, on August 4, 1908, seven months after her admission to the hospital, she was very thin and emaciated, and there was marked symmetrical exophthalmus of both eyes. There was a small goitre present; the pulse ranged between 130 and 140 and there was a systolic murmur at the apex. The nervousness and choreic twitchings were the most marked he had ever seen. A blood examination showed the changes proven by Kocher to be characteristic of Graves's disease. In her case, the polymorphonuclear leucocytes were 44 per cent., and the lymphocytes were 56 per cent.

Operation seemed to be the only means of speedy relief, and in order to prevent further vascular changes was urgent. To perform the classical partial thyroidectomy in one sitting was deemed extremely hazardous in view of the patient's poor general condition, so the plan advocated by Kocher of doing the operation in stages was adopted. The right superior thyroid vessels were tied on August 5, under local anæsthesia with one-eighth per cent. solution of novocain, combined with adrenalin, and without preliminary morphine. No symptoms resulted from this procedure, nor was there any improvement in her condition, as was to be expected from so slight an influence in decreasing the secreting power of the gland. Accordingly, ten days later, the left superior thyroid vessels were similarly ligated, using the same anæsthetic. The change in the patient's condition thereafter was very striking. She immediately began to improve mentally and physically, and in seven weeks she had gained fifteen pounds in weight. The choreic movements soon ceased entirely, she became much less nervous and was able to eat and sleep well. After eight weeks, however, her improvement seemed to come to a standstill, as the pulse rate remained at 110. Accordingly, 44 days after the second operation, the right lobe and part of the isthmus of the thyroid were removed under novocain (one-eighth per cent. solution). The two previous operations of ligation of the superior thyroid vessels had improved the patient's general condition to such an extent that a general anæsthetic at this time would have been fairly safe; still it was felt that it would be better to eliminate this danger by avoiding a general anæsthetic if possible. The youth of the patient, however, rendered the question of the painless application of a local anæsthetic problematical. She was given a hypodermic of a quarter of a grain of morphine before the operation, and the local anæsthetic was introduced after the method employed by Riedel. It consisted in inserting a long needle, attached to a large glass syringe, at the mid-edge of one sternomastoid, into the subcutaneous tissue, the solution being forced in until there was a marked swelling. The needle was then gradually carried across the front of the neck to the opposite side, injecting the solution in its progress. It was then withdrawn almost to the point of entry and inserted deeper, an effort being made to get beneath the deep fascia of the neck. It was then pushed inwards and upwards along the front of the upper surface of the thyroid gland to the opposite side. It was then again nearly withdrawn, and again carried across the front of the lower portion of the thyroid. In this way the entire front of the capsule of the gland was bathed in the solution, and, in addition, the cutaneous cervical nerves were rendered insensitive. The thyroid could then be exposed without any pain whatsoever. The landmarks, however, were obscured to some extent by the gelatinous condition of the tissues, but this soon disappeared. The posterior part of the capsule, the clamping of some of the vessels, the region of the trachea and particularly the dragging on the latter, presumably due to its vagus nerve supply, were apt to be accompanied by some pain. At this stage it might be advisable to administer a few drops of ether to complete the extirpation, but in the above case it was not necessary to do so.

In a more recent operation of the same kind, Dr. McWilliams said, scopolamine, 1-100th of a grain, and morphine, one-quarter grain, were injected in two doses, the first being given an hour and a half and the second three-quarters of an hour before the operation. The patient was then in a semi-somnolent condition, and the local anæsthesia was almost perfect.

In the case shown, the convalescence after the removal of one lobe and part of the isthmus was uneventful. The highest postoperative temperature was 103. On the eighth day the pulse had dropped to 74, and the blood pressure was 95. Fifty-two days after the third operation the blood examination showed that the polymorphonuclears had increased from 42 per cent., the number present prior to the first operation, to 81 per cent., while the leucocytes had decreased from 56 per cent. to 13 per cent.

The blood pressure was 110. Four months after the third operation her condition was entirely satisfactory, and it could be asserted that the patient was cured of her symptoms of Graves's disease. Her pulse at this time was 78. The slight systolic murmur at the apex persisted. The exophthalmus had disappeared and there was no nervousness nor tremor. The blood examination showed the total leucocytes to be 10,200; the polymorphonuclears were 74 per cent., and the lymphocytes 26 per cent. To-day, six months after the operation, the girl remained in perfect health.

With reference to the mortality after operation for exophthalmic goitre, Dr. McWilliams said he had collected 1,055 cases operated on by Kocher, Mayo, Klemm, Garre, Riedel, Krecke, Crile, Halsted, and Ferguson, and among these there were 48 deaths, or 4 per cent., a mortality which was certainly no greater than that occurring after the majority of capital operations. The benefits resulting from surgical measures were best shown in 514 patients operated upon by the above surgeons. Of these, 72 per cent. were cured, 15 per cent. were greatly improved, 11 per cent. were slightly improved, while but 3 per cent. were unimproved.

In order to compare the results obtained by medical measures with those by operative procedures, Dr. Rogers had kindly furnished him with the statistics of about 300 patients treated with the Rogers and Beebe anti-serum. Of these, 20 per cent. were cured, 60 per cent. were improved, 10 per cent. were unimproved and 10 per cent. died.

In reply to the question whether he thought that ligation of the arteries on both sides at the time the gland was resected would jeopardize the vitality of the parathyroids, Dr. McWilliams replied that Dr. Crile ligated all four vessels at the time of the operation. Mikulicz and von Rydygier have done likewise. Kocher also at times tied all the vessels, but not at a single sitting. Personally, the speaker said he would not care to take the risk of tying off all the vessels for fear of tetany by reason of damage to the parathyroid. In a recent conversation with Dr. Harvey Cushing, the latter said that as long as the parathyroids were present in the tissues, he thought they would receive sufficient nourishment from the neighborhood even if all the blood-vessels of the thyroid were tied off.

Dr. McWilliams said that on the European continent, local anæsthesia is much more generally used for these thyroidectomies than in America. Thus Kocher uses it exclusively, as do also Riedel, Klemm, Hildebrandt, Socin, Roux and others. On the other hand, we find that general anæsthesia is preferred by Moebius, Garre, Krecke, Crile, von Eiselsberg, Dumont, Braum and the Mayos. If local anæsthesia be not used in cases of Graves's disease, the plan advocated by Crile (ANNALS OF SURGERY, June, 1908) seems much the best. He attempts to do away with the mental excitation with its consequent surgical risk, by performing the operation without the patient's knowledge.

EXOPHTHALMIC GOITRE—NOVOCAIN ANÆSTHESIA.

DR. CHARLES L. GIBSON presented a woman, 29 years old, who was admitted to St. Luke's Hospital, in the service of Dr. Van Horne Norrie. She gave a history of having had scarlet fever about eighteen months prior to her admission, and following this attack the symptoms of exophthalmic goitre came on rather suddenly. Her pulse averaged about 120. There was tremor, with marked nervous manifestations, and the right lobe of the thyroid was distinctly enlarged. The patient was kept under medical treatment for eight weeks, including eight injections of Rogers and Beebe serum, without resulting benefit, and losing weight.

Operation: This was done under local anæsthesia, at a single sitting. The anæsthetic used was a 2 per cent. solution of novocain, with a few drops of a 1-1,000 solution of adrenalin. After the external incision, very little anæsthetic was required. In this case, Dr. Gibson said, as in several others he had done, he did not think it advisable or necessary to remove the extreme pedicle of the gland. To do so would have required a rather prolonged dissection; so, as a time-saving measure, he simply cut it off and cauterized the stump. The incision employed in this case was that of Kocher. The patient made an excellent convalescence, and since the operation, which was done a month ago, her symptoms had practically disappeared.

VOLVULUS OF THE SIGMOID.

DR. WILLIAM B. COLEY presented a patient upon whom he had operated for the relief of this condition, with a description of the case and remarks upon the disease, for which see page 464.

DR. MURRAY raised the query whether the case reported by

Dr. Coley was a true volvulus of the sigmoid. With such a condition as described by him we might expect some evidence of gangrene of the gut. Instead of a case of volvulus, it appeared to him that it might have been one where the sigmoid was bound down by adhesions. Only a week ago, at the New York Hospital, a patient was admitted to his service with the diagnosis of tumor of the lower end of the sigmoid, and the physician who sent the man in reported that he had actually seen the growth through the proctoscope, after the instrument had been introduced for a distance of five inches. The patient gave a history of slowly increasing obstruction, with some pain in the left iliac fossa, and at times marked abdominal distention. The movements from his bowels consisted of small particles of ribbon-shaped fecal matter.

Dr. Murray said that he introduced the proctoscope for a distance of eight and a half inches, but failed to find any tumor. He thereupon opened the abdomen, and found that the sigmoid was rather distended, and at its lower part was bound down to the pelvis by adhesions. The patient said that whenever he had an attack of indigestion, he had noted distinct abdominal distention. The adhesions were severed, and since then the patient has had several natural movements of the bowels and is rapidly recovering.

Dr. Dunham said that during his term of service at Bellevue Hospital a patient was admitted whose abdomen was immensely distended and as hard as a drum. He died without operation, and the autopsy showed that the abdomen was largely occupied by a tremendously distended colon and a valvulus of the sigmoid. This had evidently been a chronic affair, because the distended sigmoid passed across the abdomen and occupied the right hypochondriac region, where it lay on the liver. The liver was misshapen and had adapted itself to this position of the sigmoid.

Dr. Coley, in reply to a question as to the rarity of this condition, stated that it must be extremely rare. Among 121 cases of volvulus seen at the Massachusetts General Hospital there were only 2 involving the sigmoid, and among 103 cases seen at the Johns Hopkins, there were only 3 of the sigmoid.

Dr. Joseph A. Blake said he was of the impression volvulus of the sigmoid was not as rare as was inferred by Dr. Coley. Some years ago he showed a patient upon whom he had operated three times for recurrent volvulus of the sigmoid. A distinction should be made between partial and complete volvulus, based on the degree of rotation of the gut. A complete volvulus would not have been relieved by simply opening the gut and introducing a cannula, as was done in the case reported by Dr. Coley.

Dr. Coley, in closing, said that in his case the symptoms were almost identical with those described by Bloodgood; in that instance, the man had thirty-two attacks in the course of the last sixteen years, and the true condition of affairs was demonstrated by operative findings. Bloodgood states that the sigmoid remained dilated, and as it rose a kink was produced, pressing on the rectum and producing obstruction. In his own case, Dr. Coley said there was no doubt about the attacks of complete obstruction from which the patient had suffered, and the gaseous distention of the sigmoid was apparently the primary and important factor.

CARCINOMA OF THE TRANSVERSE COLON.

Dr. Charles L. Gibson presented a woman, 55 years old, who had apparently been in good health up to four months ago, when she noticed a lump in the abdomen and began to lose flesh fairly rapidly. The operation, which was done on March 26, 1909, showed a carcinoma of the transverse colon, with implication of the glands in the omentum. The involved gut was resected and the wound was closed. About two weeks after the operation there was a small amount of fecal leakage, but this gradually subsided, and the wound was now practically healed. Aside from this, the patient's convalescence was uneventful.

In connection with this case, Dr. Gibson showed the Cawardine forceps, which he had found very serviceable in intestinal resection. With these forceps the gut could be held without danger of slipping, and the completion of an end-to-end anastomosis was thus facilitated.

In reply to a question as to whether he had any difficulty in approximating the distal and proximal segments of the gut, Dr. Gibson replied that in this case the approximation was extremely easy. The entire operation did not last over forty-five minutes.

PISTOL-SHOT WOUND OF THE AXILLARY ARTERY: LIGATION OF THE FIRST PORTION. RECOVERY.

Dr. Frank W. Murray presented a man upon whom he had operated for a pistol-shot wound of the axillary artery, and discussed such wounds in a paper, for which see page 448.

CARCINOMA OF THE URINARY BLADDER.

Dr. Charles L. Gibson showed a urinary bladder removed post mortem. The patient from whom it was obtained had been shown by Dr. Gibson at a meeting of this Society in April, 1904, with the history that in 1891 he had been operated on by Dr. Edward L. Keyes for a villous papilloma of the bladder. Subsequent to this operation, he remained comparatively free from symptoms for over ten years; then there was a recurrence of the pain, frequency and hæmaturia from which he had originally suffered,—and when Dr. Gibson saw him, in 1904, he was almost exsanguinated and was passing large quantities of blood from the bladder. A suprapubic cystotomy showed an extensive carcinoma involving almost the entire bladder. The growth was removed as thoroughly as possible, the wound healed without any trouble, and subsequent to the operation the man was fairly comfortable—his bladder holding about ten ounces of clear urine. He got along well until about two months ago, when his symptoms recurred, with a rapidly fatal issue.

The autopsy showed carcinomatous deposits at two points in the bladder, one above the left ureter and the other higher up. A careful inspection of the bladder seemed to indicate that some parts of the carcinomatous bladder had healed since the operation in 1904. At that time the pathological diagnosis was epithelioma. The patient, at the time of his death, was extremely anæmic. No metastases were found.

VOLVULUS OF THE SMALL INTESTINE IN A CHILD.

Dr. William A. Downes showed this specimen, which consisted of a loop of ileum 36 inches in length, removed from a child, seven years old, on April 4, 1909, at St. Francis' Hospital in the service of Dr. F. Kammerer. The history obtained was that of sudden abdominal pain, with vomiting and extreme shock. The case was regarded as one of intussusception. On operation, thirty hours after the onset of symptoms, this loop of intestine was found. It was turned on its mesentery 360 degrees, and extended to within two inches of the ileocæcal junction. It was partly gangrenous. A resection was done and a lateral anastomosis formed between ileum and ascending colon. The child was now making a good recovery.

TRANSACTIONS

OF THE

PHILADELPHIA ACADEMY OF SURGERY.

Stated Meeting, April 5, 1909.

The President, Dr. William J. Taylor, in the Chair.

GREEN-STICK FRACTURE OF THE LOWER END OF THE ULNA COMPLICATING FRACTURE THROUGH LOWER PART OF THE RADIUS.

Dr. John B. Shober presented a series of radiograms which, he said, illustrated the importance of studying a radiogram made immediately after the setting of fractures.

On September 25, 1907, Margaret S., age 8 years and 10 months, fell from the back of a chair, striking on her right extended hand. The typical deformity of Colles's fracture of the radius presented itself. Twenty minutes after the accident, under chloroform anæsthesia, he set the fracture and applied a Levis splint. Though exercising great care he could not set the fracture to his entire satisfaction. The next morning he removed the splint and took the radiogram (Figure 1). It shows imperfect reduction of the fracture of the radius, which is accounted for by a green-stick fracture of the lower end of the ulna. The same afternoon he again anæsthetized the child, and by manipulation succeeded in straightening the green-stick fracture and obtained perfect reduction of the radial fracture, as can be seen in Figure 2, made through a Bond splint. Compare the lines of the outer and inner borders of the ulna and the relative position of the articulating surfaces in each picture. Also compare these pictures with Figure 3, a radiogram of the normal left wrist.

The point Dr. Shober wished to emphasize was, that without the aid of a radiogram the green-stick fracture of the ulna could not have been determined, and unless it was straightened the fracture of the radius could not have been properly reduced, and the surgeon's course would have been reflected upon for a resulting partially deformed and lame wrist.

BILATERAL WRIST DEFORMITY DUE TO OSTEITIS OF RADIUS AND LUXATION OF THE ULNA.

Dr. Shober reported the case of a little girl, 12 years old, who was referred to him December 10, 1908. She is a bright, intelligent, well-nourished child who, with the exception of an attack of chicken-pox when six years old, has always enjoyed good health.

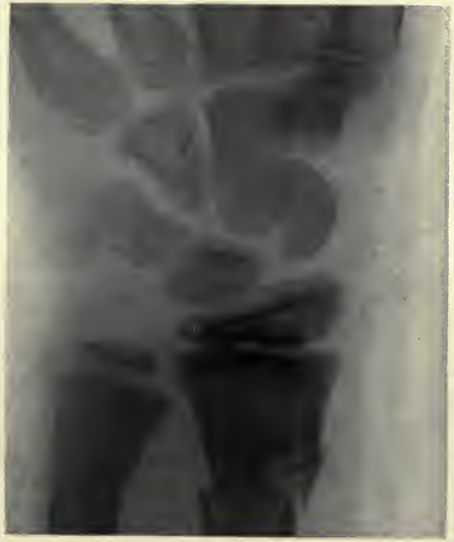
Her parents have been married thirteen years and have one other child, born two years ago. Her mother states that she has had one miscarriage, which occurred one year before the birth of the last child, and that she has always been subject to attacks of so-called quinsy, and that before her marriage and for many years afterwards she had a series of abscesses in various parts of her body. There is no history of tuberculosis in her family. The father had an uncle who died of tuberculosis of the lungs. Otherwise his personal and family history is good.

Eight months before Dr. Shober saw the child she began to complain of dull, subacute and continuous pain in both wrists. Three months later, her mother noticed that the wrists were swollen, and they have continued to enlarge since then with some increase of pain.

Upon examination there was no limitation of motion of the wrist joint, with the exception of slightly diminished power of supination. The styloid processes of both ulnæ stood out prominently from the wrists and the skin over them seemed slightly congested. Pressure over the lower ends of the radii and ulnæ caused slight increase of pain, but there was no evidence of arthritis or enlargement of bone. The deformity was evidently due to dislocations of the radio-ulnar joints of the wrists. A radiogram not only confirmed the diagnosis but also showed the cause to be osteitis of the lower epiphyses and absorption of bone tissue of the inner side of both radii, allowing spontaneous dislocations (Fig. 4).

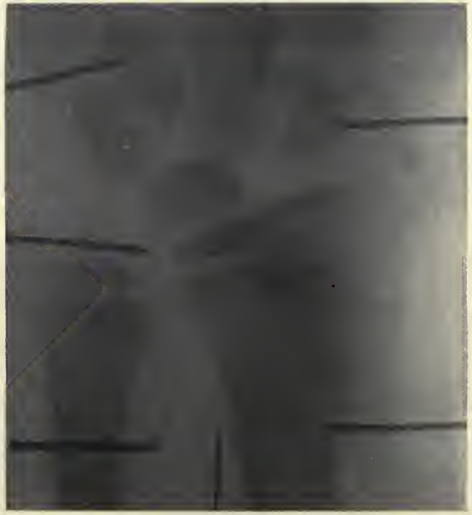
There being no marked tuberculous history in the family, and the lesions being bilateral and history of the mother sus-

Fig. 1.



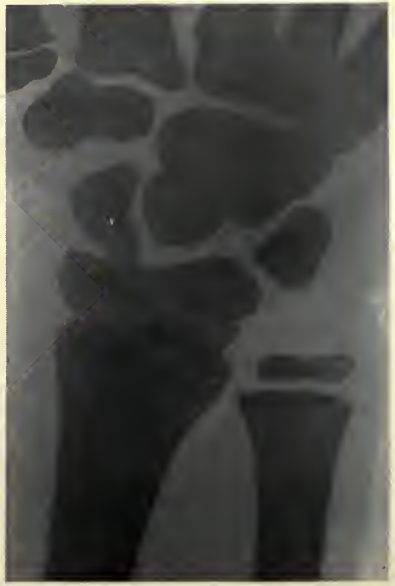
Fracture of radius near its lower end simulating Colles' fracture, complicated by green-stick fracture of the ulna. Appearance after first attempt to reduce

Fig. 2.



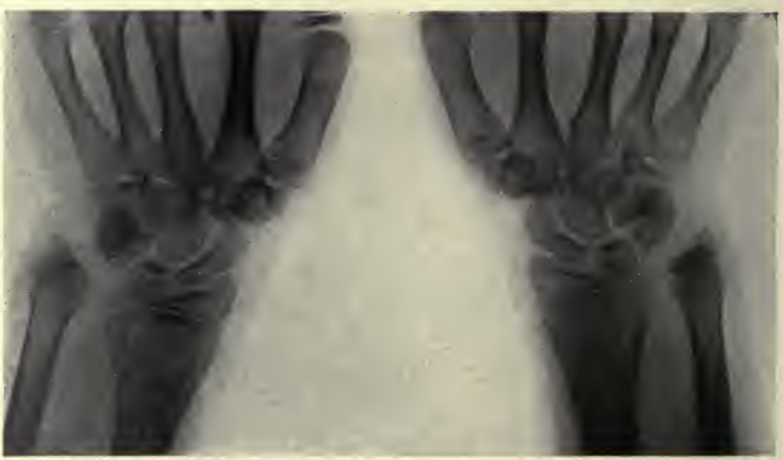
Appearance after setting of green-stick fracture of ulna.

Fig. 3.



Normal left wrist.

FIG. 4.



Bilateral luxation of ulnæ, consequent upon osteitis of radius.

picious, he was inclined to look upon the case as a late manifestation of hereditary specific disease. This theory is borne out by the result of the therapeutic test, under which improvement is taking place. The child is now taking 10 grains of potassium iodide three times daily, and since the beginning of treatment the wrists have been supported and put at rest by an easily applied splint which she wears during the day.

Dr. Richard H. Harte expressed the opinion that the condition of the bones of the forearm described by Dr. Shober was due to an arrest in development of the epiphyseal end of the radius, caused by either tubercular disease or syphilis. From the report, it would seem that the latter was responsible for this arrest in development, inasmuch as the patient undoubtedly improved upon specific treatment. Dr. Harte had, however, seen in a case in the Orthopædic Hospital, nearly the same condition, which was distinctly the result of tubercular disease, and improved very much upon appropriate treatment.

Dr. Henry R. Wharton thought the deformity to be largely due to an osteitis. There was no marked osteitis at the lower ends of the ulna in either arm. The osteitis has resulted in a certain lack of growth in the length of the radius which has tended to throw the wrists into the position they now occupy. He had seen a similar deformity in a child following an injury of the lower epiphysis of the radius. The most probable explanation of this condition was specific infection of the bones.

Dr. Robert G. Le Conte agreed in the diagnosis of specific disease in this case, because the disease came on insidiously, without traumatism, was symmetrical and occurred at the same time in both wrists. These combinations are certainly most unusual in any other disease. The peculiar deformity was due to the inner articular surface of the radii being more prominent than the outer aspect, which has prevented the hand from rocking over to the inner side. The growth of the radii has been interfered with, and that the seeming great growth of the ulna is due to their normal development. Therefore, as the radius forms the larger part of the wrist joint, the growing ulna could not get sufficient purchase upon the carpus to rotate it inward, and dislocation had to take place.

Dr. Astley P. C. Ashhurst suggested the possibility of this case being one of Madelung's disease—spontaneous subluxation of the wrists. This is an affection which, within the last year or two, it has become customary to classify among the congenital dislocations, though the speaker could not see on what grounds. Its first symptoms usually are manifested about the age of puberty; it affects particularly females; is characterized by the prominence of the lower ends of the ulnæ, by slight radial deviation of the hand, and, in its more advanced stages, by subluxation forwards of the radiocarpal joint. Especially characteristic is the widening of the interosseous space, due to the incurvation of the lower end of the radius, as is well shown in the skiagraphs presented. In the three or four cases which have come under his notice the disease was considerably more advanced, the ages of the patients varying from 15 to 18 years, and the deformity being so characteristic that no chance for error arose in making the diagnosis. In Dr. Shober's patient the affection of the wrists has existed for only a few months, and while of course it may not be a case of Madelung's disease, it would be interesting to know whether in the course of the next three or four years the progress of the case might not justify such a diagnosis.

TREATMENT OF DIFFUSE SEPTIC PERITONITIS.

Dr. Robert G. Le Conte read a paper entitled, "Treatment of Diffuse Septic Peritonitis," for which see page 457.

Dr. Le Conte said that he had brought these cases before the Society because he thought they might again with profit enter upon a discussion of the treatment of diffuse septic peritonitis. It would be noticed that Dr. Stewart and he had varied in the treatment adopted. Dr. Le Conte firmly believed in the Murphy principles—short operation, removal of the cause of the peritonitis, the least possible manipulation of the peritoneal cavity outside of the area in which work must be done, the draining of the lowest portion of the peritoneum, and, in order that the fluids may gravitate there, the exaggerated Fowler position, with the ingestion of large amounts of water by the large bowel.

He had followed the above principles in his treatment of diffuse septic peritonitis for about three and one-half years, and was sure that he had had a far greater number of cases recover than formerly. An examination of the nine cases here reported, perhaps too few a number to make any deductions, shows that he had operated upon three with one death, while Dr. Stewart, using a different technic, operated upon six with no death. In the case that died, it is quite probable that the disease had gone beyond the peritoneum before operation, and that the death was due to absorption through channels over which he could have no control. Without having made a definite analysis of all his cases of diffuse septic peritonitis, he estimated that the mortality is now in the neighborhood of 15 per cent. where formerly it was four or five times greater.

Dr. Richard H. Harte said that the results in cases of peritonitis vary a great deal with the time the surgeon gets the case, the duration of the patient's illness, and the character of the infection.

With regard to the after treatment in these cases, the question of drainage is of paramount importance: meaning thereby, drainage by posture, gravitating the intraperitoneal contents into the pelvis and then opening the abdominal cavity and inserting large pieces of gauze drain. This has two effects: first, the removal of the purulent contents from the pelvis, and, second, the relief of tension, which is also an important factor and undoubtedly does delay the tendency to septic absorption; then thorough enteroclysis, after the method of Murphy, in which large quantities of water are kept in the rectum and even up into the colon.

The methods as mentioned by Dr. Le Conte are pretty much the same as those followed in the Pennsylvania Hospital, where the results are most favorable. The speaker said that he was very fond of placing the patients upon their side, or even on their face, when their condition will permit, so as to facilitate drainage in abdominal incision, as in that way, an immense amount of septic material can be drained from the pelvis simply as the result of gravity.

At one time he was more in favor of general douching of the peritoneal cavity, but now he is getting further away from that, and will continue to mop out the field of operation, using as little fluid as possible, except when the peritoneal cavity is distinctly soiled as the result of the escape of intestinal contents, as following typhoid perforation, duodenal ulcer, etc. The best results are when one does as little manipulation of the peritoneal cavity as possible.

Dr. G. G. Ross said it was a very interesting problem: What is the proper course to pursue in treating cases of purulent peritonitis? Dr. Stewart washes them out and gets them well, and Dr. Le Conte does not wash them out and also gets them well, and it seems to be the general experience that both methods give good results. However, one does better if one saves the time spent in washing out. Murphy explains that whether this treatment is or is not beneficial, the real question is whether the infection is confined to the inside of the peritoneal cavity or beyond it, in the retroperitoneal space and in the retroperitoneal lymph channels. If behind, it does not make much difference what you do—operate or not, wash or not, your patient dies just the same. If it is inside of the peritoneum the peritoneum will take care of the poison if you provide an outlet for the excess of the poisonous material. Dr. Le Conte's method seems the better one of the two—the removal of the cause in the shortest time, with the least amount of work inside the peritoneal cavity, and drainage, thus lowering the intra-abdominal pressure, a distinct advantage in the control of the infection.

Dr. Robert G. Le Conte, in answer to a question as to bacteriological observation in his cases, said that in some of the cases bacterial cultures were made of the peritoneal contents at the time of operation, but not in all. The colon infection is far more favorable than the streptococcus. He agreed with the statement made by Dr. Ross, that the cases one can save are those in which the infection is confined to the peritoneum, and that when the infection has already spread to the retroperitoneal spaces most of the patients die. The less done to a peritoneum coated with lymph, the better, and, for this reason he did not wash the peritoneal cavity except where he feared the presence of foreign bodies, as undigested food from perforation of the stomach. The relief from pressure which the incision gives in a lymph-coated peritoneum is usually sufficient to prevent further absorption of toxic materials, and the absorption of large quantities of fluid will tend to carry off such septic material as has already entered the circulation, through the action of the kidneys and the bowels. As to the use of morphia, he had not the slightest hesitancy in using this drug in sufficient quantity to make the patient comfortable after an abdominal operation, in either septic or non-septic cases. In the septic cases he was particularly prone to use it to check peristalsis and permit the inflammation to limit itself. Rest to the intestines is a great thing, and morphia gives this to perfection.

ŒSOPHAGOSCOPY AND GASTROSCOPY.

Dr. Benjamin A. Thomas reviewed the century from 1806, when Bozzini first examined the upper end of the œsophagus, to 1906, when Jackson devised and perfected his œsophagoscope and gastroscope, noting the earnest but futile efforts of such men as Mikulicz, Rosenheim, and Rewidzoff to place endoscopy of the upper alimentary tract on a sound basis. He noted the advantages of introducing the instrument by direct vision and strongly condemned the use of the bougie, coin-catcher and horse-hair probang. Attention was called to the advantages to be derived from the use of a straight tube, equipped with the light at the distal end and the elliptical form of the tube in cross-section.

The gastroscope should receive more frequent use in the early differential diagnosis of chronic gastritis, cancer and ulcer. General anæsthetic should always be employed in gastroscopy unless there exists some intercurrent grave organic disease to contraindicate the procedure. He rarely resorts to a general anæsthetic in simple œsophagoscopy.

He pleaded for more accurate methods in the diagnosis and treatment of conditions of the upper alimentary tract, and quoted statistics of the University Hospital to the effect that 50 per cent. of the cases diagnosticated "stricture of the œsophagus" died of carcinoma although the true nature of the stenotic process was undetermined at the time of admission; 75 per cent. of the cases of stomach disease suffered from carcinoma, ulcer and gastritis. He thought the differential diagnosis, therefore, between these conditions, especially early in the course of the disease, to be the most notable effort of the modern gastrologist, and believed this, at times, perplexing problem, to be nearer solution to-day by recourse to the straight, hollow-tube instrument than it has ever been. Its field of usefulness is not limited to a diagnosis of the various diseases of the stomach and œsophagus per se, but in the removal of foreign bodies, etc., it plays an important rôle.

He cited four cases in which œsophagoscopy or gastroscopy or both were performed, submitting colored drawings of the lesions in situ, from some of which sections of tissue removed for microscopical diagnosis demonstrated carcinoma.

His conclusions are:

The straight tube is the most useful model of instrument which has ever been devised for purposes of diagnosis of lesions of the œsophagus and stomach, and its use is attended with uniform success.

By virtue of the fact that the instrument is always introduced through the lumen of the œsophagus under direct inspection, no danger can arise from injury to adjacent ulcers, venous varicosities, aneurism, neoplasm, etc.

Resort to the employment of the gastroscope offers a method for the early differential diagnosis of cancer, when the symptoms are vague and it is still in the curable stage.

General anæsthesia should always be used for gastroscopy and rarely for œsophagoscopy.

Œsophageal bougies, coin-catchers and horse-hair probangs have no place in modern surgery.

In addition to advantages in diagnosis, the use of the scopes for purposes of treatment, as in the removal of foreign bodies, is inestimable.

Dr. John H. Jopson said that Dr. George Clymer Stout and he had had a small series of cases at the Presbyterian Hospital in which they had used the Jackson instruments, and he would make brief mention of three cases:

The first patient was under the care of Dr. Musser, a boy with a tack deeply lodged in the right lung, where it had been embedded for some months. The skiagraph showed it very plainly opposite the head of the eighth rib, and located in the posterior portion of the lung. The tack was below the bifurcation of the right bronchus and a careful use of the tube failed to remove it.

The next case was in the person of a child of 10 months who was referred with a diagnosis of a safety pin in the œsophagus, where it had been embeded for between three and four weeks. The X-ray showed the pin open in the œsophagus, with the point upward, open to its fullest extent behind the clavicle and first and second ribs. They undertook its removal by the œsophagoscope and the safety-pin closer of Dr. Sidney G. Ankauer of New York. They saw it, then it became dislodged and they did not see it again. An X-ray made immediately after the sitting disclosed the pin the stomach, and three days later he successfully removed it by gastrotomy.

The third case was one of laryngeal papilloma, in a child who had been under their care for four years and is now about seven years of age. When he was three years of age a tracheotomy was done on account of an increasing obstruction of the larynx due to laryngeal papilloma. He had worn a tracheotomy tube since then. By the use of the bronchoscope on two occasions they were able to thoroughly clear out the papilloma from above. He has had the tracheotomy tube corked up for a month and is breathing and talking in a very satisfactory manner. In these young children in whom removal of the papilloma by aid of the laryngeal mirror is very unsatisfactory, the Jackson tubes offer a very good means for their extirpation under direct inspection.

DR. BENJAMIN A. THOMAS, commenting upon the difficulty of examinations of the bronchial tubes, recalled the case of a colored child six years old which illustrated that the younger the child the more difficult is the operation, because of the necessity of employing smaller sized tubes. This child had the history of a tack in his lungs and the X-ray showed it to be presumably in the left bronchus about its bifurcation into the second division. The introduction of the 5 mm. bronchoscope showed an area of partially necrotic mucous membrane extending from the division of the left bronchus down into the left inferior lobe bronchus for 3 or 4 centimetres. In the lumen of the left inferior lobe bronchus was a quantity of pus, about an ounce or an ounce and a half. The tack was not visible, being evidently embedded in the mucous membrane which was considerably swollen and partially necrotic. After a rather prolonged search the operation was abandoned and two months later the child was running around and was in fairly good health, excepting for an occasional cough. About a month ago he had looked up the history of this case to see what the end result was, and learned that three months after the child left the hospital the tack was expelled one night in a paroxysm of coughing.

CORRESPONDENCE.

THE SURGICAL TREATMENT OF LOCOMOTOR ATAXIA.

EDITOR ANNALS OF SURGERY:

IN an article published in the June issue of the ANNALS OF SURGERY, and written by Dr. Denslow, some reference is made to the fact that a number of patients from my clinic were treated in accordance with Dr. Denslow's method. It is only just to me to state, (1) that these patients, eight in number, were undoubtedly suffering from locomotor ataxia, having been seen by Dr. Cunningham, my chief-of-clinic, and so diagnosticated; (2) that there was a slight amount of improvement in the control of the bladder and rectum, and a slight amount of improvement in the walking. In no case was there any cure of the disease, as all the physical signs remained and the majority of the symptoms of the disease remained, in consequence of which I sent a letter to the *New York Times* the day after the publication in that journal of a sensational article in which the statement was made that a cure for locomotor ataxia had been found. I may state, that in all the cases treated at the clinic no further improvement occurred; the majority of these cases have relapsed, so that at present their condition is worse than before the treatment was begun. Hence no permanent relief of symptoms even has been secured, to say nothing of a cure of the disease.

The claim made by Dr. Denslow that irritation of the urethra is a serious complication and possible cause of the disease in locomotor ataxia has led me to submit fifteen private patients suffering from this disease in various stages and of various degrees of severity, to the examination of Drs. Bangs and Hayden. In the majority of these cases no irritation, stricture, ulcer or any defect was found in the urethra by careful endoscopic examination—a form of examination which patients who have been under Dr. Denslow's care state that he has never made with them. In two cases Dr. Bangs found a slight abrasion of the urethra, the healing of which had no effect upon the symptoms of locomotor ataxia. In one case Dr. Hayden found an extensive ulceration of the urethra, and this patient recovered the control of the bladder and rectum after this ulceration had healed, and hence he was benefited; his ataxic gait and pains were not in any way affected. These are records of private patients. More than twenty patients suffering from the disease were submitted to examination and treatment in Dr. Hayden's department at the Vanderbilt Clinic. In a small percentage only of these patients was any urethral irritation or ulceration found, and in none of them did subsequent treatment of this condition have any apparent effect upon the course of the disease.

It is well known that in the course of locomotor ataxia spontaneous remissions of symptoms occur which have lent credence to the statement that various methods of treatment are of great benefit. Thus the method of suspension advised by Charcot and long extolled as very valuable has now fallen entirely into disrepute. Patients suffering from locomotor ataxia are often neurotic and are quite subject to suggestive treatment. This I have seen in cases which have improved rather remarkably for a short time under such treatment. It is possible that accidental improvement under his treatment has led Dr. Denslow to the erroneous opinion that his method is of real value. I wish to put myself on record as believing that it is without any value whatever.

M. ALLEN STARR.

NEW YORK, June 19, 1909.

A NEW METHOD OF NEPHROPEXY.

EDITOR ANNALS OF SURGERY:

In spite of the large number of reliable methods of nephropexy at our command we must still record failures, a fact which justifies the search for a method which will guarantee absolute fixation of the kidney. To what extent I have succeeded by my method is to be left to the opinion of my *confrères*. Its essential point is the fastening of the kidney to the twelfth rib by thin bronze wire after the rib has been perforated with a drill.

The first patient on whom I carried out this method was a lady of 30 years. On April 14, 1908, I exposed the right displaced kidney and divided the periosteum of the twelfth rib in the middle, parallel to its margins. After reverting the periosteal flaps thus created, I introduced the periosteotome between the posterior surface of the rib and the periosteum, freeing it by the instrument at the same time. Sufficient space was now obtained to push in my abdominal spoon, which was to serve as a protector while a hole was bored through the rib. This prevents any possible injury to the pleura while boring. A dull needle armed with the bronze wire, whose flexibility makes it preferable to the silver wire, was thrust through the upper renal pole. The latter was now drawn toward the rib and fastened there after the wire had passed the hole. The lower periosteal flap was then reverted and pushed between wall and kidney. This arrangement fortifies the attachment. Twisting of the wire is done tenderly, any strangulation of the kidney substance being carefully avoided. The wire is left *in situ* and its twisted ends must not be cut too short. (In a second case I attempted to cut the ends very short and, as the Röntgen plate showed, the twisting proved to be insufficient. I had to reopen the area of operation, which revealed the interesting fact that adhesion formation between periosteum and renal surface had grown thorough and extensive. I therefore refrained from introducing a new wire but simply extracted the separated fragment, which I had placed there three weeks before.)

Two tiers of catgut sutures were applied. The area of operation was immobilized by a large piece of moss-board. The patient could get up after a week and has remained well ever since. A Röntgen picture taken six months after the operation showed the wire in correct position.

New York, June 15, 1909. Carl Beck.

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ANNALS OF SURGERY

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ORIGINAL MEMOIRS.

AN ANALYTICAL AND STATISTICAL REVIEW OF ONE THOUSAND CASES OF HEAD INJURY.

(Continued from vol. xlix, page 613.)

BY CHARLES PHELPS, M.D.,
OF NEW YORK CITY,
Surgeon to Bellevue and St. Vincent's Hospitals.

SYMPTOMATOLOGY.

I.—CONSCIOUSNESS AND MENTALITY.—The primary mental disorder was ascertained from the ambulance record, or, if this were impossible, was assumed from the patient's condition upon immediate admission to the hospital; and as here formulated, loss of consciousness might be either transient, considerably prolonged, or permanent.

CASES IN WHICH THE PATIENTS WERE:

Entirely unconscious, Fatal, 318; Recovering, 224	542
Practically unconscious, Fatal, 30; Recovering, 46	76
Conscious with mental state normal, Fatal, 80; Recovering, 209	289
Conscious with mental state abnormal, Fatal, 24; Recovering, 28	52
Not mentioned	41
Total	1000

The term "practically unconscious" is used for want of one that is better, and indicates a condition in which there is no manifestation of consciousness except a recognition of painful sensations, or one in which the patient can only with difficulty be momentarily aroused.

The primary mental disorders were: apathy; delirium, mild or active, muttering or alternating with stupor; and a deficient intelligence as manifested by an inability to realize surroundings, the fact of injury, or even personal identity.

The cases in which no mention is made of primary mental conditions are those of patients transferred from other institutions; and a larger number, usually of gunshot wounds, in which the patient was found unconscious with no obtainable earlier history. It seems probable that the primary condition was in the majority of cases one of unconsciousness in both the second and third classes.

Primary unconsciousness was followed by its immediate loss in about 35 per cent. of fatal cases, and in general was always lost before the close of life. The only exceptions were in cases of intercurrent disease, or from apnœa from the supervention of pulmonary œdema or compression of the respiratory ganglia. In a limited number of cases, as of meningitis, prolonged delirium, or mental decadence, the loss might be considered indirect and chargeable to an exhaustion of the vital powers; but usually and characteristically it occurred as a direct result of the traumatism. A statement made after an earlier study of this subject, that "in a majority of cases unconsciousness is profound, or at least complete, from the receipt of injury to the close of life," requires correction. In fact, this proportion has been found to be rather less than 50 per cent. of the fatalities noted. In 39 per cent. of cases consciousness was immediately replaced by some mental disorder other than delirium.

Whatever might be the primary mental condition, delirium was the most frequent of all the later symptoms, being observed in more than 50 per cent. of that one-half of the cases in which unconsciousness was not permanent; and as a primary symptom it was the most frequent of the mental derangements when consciousness was retained.

The secondary mental changes in fatal cases were not essentially different whether consciousness was retained or lost; there was no constancy in either event. An interval of consciousness and rational intelligence following primary unconsciousness was infrequent; and an interval of stupor, apathy, or mental decadence, though oftener noted, was still confined to a very limited number of cases.

The secondary mental changes in cases which ended in recovery differed with the primary mental state. If it were one of unconsciousness, consciousness might be restored after an interval of moments only, or it might be after an interval prolonged for many days. In the first instance it was usually a direct restoration of rational intelligence; in the second it was often gradual and through stages of mental obscuration or derangement. In either event the final mental condition might be one of permanent impairment. If the primary state were one of unconsciousness and rational intelligence a reference to the tabulation of cases will show that recovery occurred in 70 per cent., as did death in 60 per cent., of those primarily unconscious, but the fatalities were still so many that the mere fact of primary consciousness or unconsciousness can be of itself no guide in prognosis. In a large number of cases which recovered, especially of fractured vertex or moderate general contusion, there was no further mental change. In others, in which hemorrhages or morbid nutritive changes in the cerebrum or its membranes were progressive, the same secondary forms of consciousness or mental derangement necessarily occurred as with the same structural alterations when consciousness was primarily lost. If primary consciousness was characterized by delirium or other mental derangement the termination was usually delayed, and the chances of life and death were nearly evenly balanced.

The relations of these varying phases of consciousness and mentality to underlying anatomical lesions will be illustrated here by some brief abstracts of cases; these like others to follow, while selected with direct reference to some one point, will incidentally illustrate other conditions to which attention will be called.

Case XXX.—*Primary and Permanent Unconsciousness. Necropsy.*—An unknown man was found unconscious in the street with stertor and general muscular rigidity. He was in profound coma on admission to the hospital, with muscles relaxed and reflexes absent, and with no hemorrhages and no evident external injuries. Temperature 97.4°; pulse 52; respiration 18; right pupil contracted and without reaction; left pupil normal. Coma continued, and temperature rose progressively to 108.2° at death eighteen hours after admission; respiration then 60, and pulse imperceptible.

Lesions.—Fracture extending from left inferior parietal region and above the petrous portion into the floor of the left middle fossa; soft epidural clot, 4 by 3 inches, and 2 inches thick, compressing laterally the left frontal, temporal, and parietal lobes, and extending to, but not into basal fossa; pial hemorrhage thinly covering vertex and forming clots in both anterior and both middle fossæ, perceptibly compressing the under surface of both anterior lobes; subcortical laceration in right posterior inferior parietal region; limited contusion of left temporal convolutions; moderate general hyperæmia and œdema confined to upper part of cerebrum.

Case XXXI.—*Primary and Permanent Unconsciousness. Necropsy.*—The patient fell down a flight of steps and was made primarily unconscious. On immediate admission to the hospital: temperature 102.2°, pulse 130, respirations 36; pupils normal; lack of vesical control; Cheyne-Stokes respiration; patellar reflex absent. Second day: pupils contracted and immovable; temperature 101.8°; coma profound. Fourth day: temperature 104.2°; progressive asthenia; no other change. Died.

Lesions.—No fractures; no epidural hemorrhages; two small pial hemorrhages, in right frontal and right parietal region respectively; limited contusion of right frontal lobe underlying the pial hemorrhage, and extending through cortex and subcortex to centre of lobe with numerous punctate extravasations; general cerebral contusion.

Case XXXII.—*Primary Unconsciousness with Subsequent Delirium. Necropsy.*—The patient was knocked down by a trolley car and rendered primarily unconscious. On admission to the hospital: temperature was 99.6°; pulse, 80; still unconscious. Some hours later he was restless and could be aroused momentarily; incoherent. In twelve hours he was fully conscious and delirious; pupils normal. For first ten days temperature ranged from 101° to 99.4°, and pulse from 80 to 88; rectal control lost; comprehension slow; descending optic neuritis discovered. Still later: active delirium which continued twenty-five days; rectal and vesical control variable; temperature rose to 103.6° and pulse to 128; alternate delirium and unconsciousness. Died on the thirty-fourth day.

Lesions.—No fractures; no hemorrhages; laceration of right frontal and temporal lobes; marked cerebral hyperæmia and œdema; cloudy subarachnoid effusion.

Case XXXIII.—*Primary Normal Consciousness.* The patient inflicted upon himself a gunshot wound of the head. He did not fall or lose consciousness for four or five minutes. On admission to the hospital: coma profound; left pupil dilated; respiration became Cheyne-Stokes and both pupils widely dilated and immovable; temperature 99°.

Operation.—Large epidural hemorrhage discovered with laceration of the arteria meningea media which was controlled by pressure. Death two hours later.

Case XXXIV.—*Primary Normal Consciousness. Necropsy.*—The patient fell from a loft to the stage of a theatre and was dazed but able to walk about and converse. Thirty minutes later while in a cab he became drowsy, and then somnolent and by his own direction was at once taken to the hospital. On admission: entirely unconscious; temperature 96°; pulse 68; right pupil contracted; left pupil dilated. Death in four hours from time of injury. Temperature 97°.

Lesions.—No fracture; epidural clot, 3½ by 3½ inches, on the right side of the cerebrum from rupture of arteria meningea media; no other hemorrhage or laceration; moderate cerebral hyperæmia and œdema.

Case XXXV.—*Primary Consciousness. Necropsy.*—On admission to hospital patient conscious and able to walk when supported, but unable or unwilling to speak; temperature 98°; muscles spastic; pupils irresponsive, and the left dilated; slight mastoid œdema and ecchymosis. Second day: apathetic; face flaccid; rubbed his face with his hands but made no response to efforts to rouse him; temperature 101°. Third day: in the morning, condition unchanged; in the evening, cyanosis and pulmonary œdema; patient unconscious; death fours hours later.

Lesions.—Fracture of cranial base involving jugular foramen; thrombus in corresponding lateral sinus; no epidural or pial hemorrhage; laceration of left cerebellar and occipital lobes with cortical hemorrhage in posterior basal fossæ; general capillary extravasation into pia mater; limited area of meningitis over each frontal lobe; thickening of meninges; punctate extravasation in left parietal and occipital lobes; laceration of right frontal lobe; hemorrhagic softening of the right frontal cortex.

CASE XXXVI.—*Primary and Permanent Delirium. Necropsy.*—The patient fell ten feet to the sidewalk and became at once actively delirious. On immediate admission to the hospital: still delirious; condition not alcoholic; temperature 99.2°; pupils normal; hemorrhage from right ear. In nine hours he became still more wildly delirious; temperature 101.4°, and so continued through the night. Second day: temperature 102°; vesical control lost; still delirious. Third day: progressive rise of temperature from 102° to 107.2°; delirium alternating with stupor. Death on the fourth day.

Lesions.—Fracture through right middle basal fossa into orbital plate; small epidural and pial hemorrhages in right parieto-temporal region; excessive cerebral œdema and moderate hyperæmia; large serous exudation into meshes of pia mater and into subarachnoid space. Some arachnoid opacity.

II.—TEMPERATURE.—Variations of temperature are perhaps the most significant of the indications of intracranial injury; and considered in connection with the phenomena of consciousness may point directly to the nature and extent of lesion, and often to its probable result.

Temperature above 98°, and not exceeding 99°, will be considered normal.

PRIMARY TEMPERATURE.

92° to 98°:	
Fatal cases	104
Recoveries	139
98° to 99°:	
Fatal cases	80
Recoveries	145
99° to 100° inclusive:	
Fatal cases	76
Recoveries	95

100° to 101° inclusive:	
Fatal cases	21
Recoveries	38
101° +:	
Fatal cases	6
Recoveries	13
102° —:	
Fatal cases	6
Recoveries	2
102° +:	
Fatal cases	14
Recoveries	0

In 42 cases the earliest temperature taken was from 102° to 105°, but in 28 of these it was taken after an interval of from twelve hours to six days from the time of injury and could in no sense be considered primary. These and similar cases were excluded from tabulation. The 14 cases remaining were brought under immediate observation.

The one case in which primary temperature reached 105° was that of a man who had jumped from a window while in the delirium of pneumonia.

HIGHEST TEMPERATURE.

100° and below:	
Fatal cases	32
Recoveries	142
100° to 101° inclusive:	
Fatal cases	23
Recoveries	121
101° + to 102° inclusive:	
Fatal cases	12
Recoveries	61
102° to 103° inclusive:	
Fatal cases	22
Recoveries	48
103° to 104° inclusive:	
Fatal cases	44
Recoveries	28
104° to 105° inclusive:	
Fatal cases	48
Recoveries	8

The temperature of 105° in a single case of recovery occurred on the sixth day and was coincident with an attack of some severe intestinal disturbance.

105° to 106° inclusive:	
All fatal cases	51
106° + to 107° inclusive:	
All fatal cases	36
107° + to 108° inclusive:	
All fatal cases	32
108° + to 109° inclusive:	
All fatal cases	9
109° + to 110° inclusive:	
All fatal cases	4

It will be observed that when the highest temperature did not exceed 103° the number of recoveries was greatly and favorably disproportionate to that of fatalities; and that when it was above that point the comparative number of fatalities was in still higher percentage than were the recoveries in the former cases. The highest temperature was not always noted at the same period in the progress of different cases, but was usually attained during the last day of life, and was invariably the case when its maximum was at or above 107°. In a single instance a maximum of 108.2° was reached as early as fifteen hours before death, and was without later remission. The rise in temperature was sometimes progressive, either from the beginning or from some later period to the end of life; but was oftener erratic, varying from hour to hour or from day to day within comparatively narrow limits; or perhaps receding from some high degree even to normal or subnormal and after an interval, long or short, again rising to or above its previous maximum. It was the rule rather than the exception that a marked increase occurred at the very end of life, or even in articulo mortis, and this was not infrequently continued for from fifteen to thirty minutes post mortem, and might be fractional or even extend to several degrees. In a case previously reported (Phelps—"Injuries of the Brain," Case 121) the final temperature was 98.6°, and thirty minutes post mortem rose to 109°.

An attempt was made to study the relation existing between opposite axillary temperatures, but was abandoned partly on account of paucity of results, and partly on account of the impossibility of obtaining efficient co-operation of hospital internes. The cases examined included a certain number both of those which proved fatal and of those which recovered. In general there was a want of correspondence in elevation, usually fractional, but occasionally extending to 1° or 2°, and the higher temperature usually, though not always, continued to be manifest upon the same side of the body. The observations were made for periods extending from one to thirty days. There was no absolute consistency in the amount of elevation or in the side upon which it was exhibited, not even during the same day; and no relation could be established between the asymmetry and the causative lesion except that there was always a general cerebral contusion; and there was none between the side of high temperature and the side on which a limited lesion existed. In every case examined temperatures taken in opposite axillæ were as a rule at all times unsymmetrical, but in no case were they at variance in every observation made.

The most salient fact observable in the tabulation of cases is that with a primary temperature above 102°, or with a subsequent temperature of 105° or above, recovery has never occurred. This is true not only of the cases tabulated, but of the whole 1000 which form the basis of this paper. An apparently exceptional instance of such recovery when temperature had reached 105° was one in which the exacerbation of temperature, as has been noted, was due to an intestinal complication.

It is further observable that more than 50 per cent. of recovering cases have had a primary temperature of from practically normal to subnormal, and in a comparatively small number it exceeded 100°; and that in fatal cases, while the primary temperature in the majority was still normal, a higher degree was proportionately much more frequently encountered later than in those destined to a favorable issue. It is evident therefore that a low primary temperature gives no assurance of the result; but that an elevation above 100° is to be regarded as unfavorable as it approaches the limit of 102°.

The dependence of temperature upon the nature, extent, and complication of intracranial lesions as deduced from an earlier examination of a moiety of these cases has been confirmed by the further examination of their whole number. Hemorrhage in itself does not elevate temperature; it reduces it as it reduces the force of the circulation and depresses all vital functions; meningeal contusion increases it, and cerebral contusion increases it to a still greater extent. If these lesions existed singly diagnosis might be predicated upon temperature alone, but they are always multiple and the effect of one is more or less modified or counteracted by that of another; and as the case progresses new conditions may be introduced as arachnoid inflammation, septic infection, or it may be a simple asthenia.

Temperature, therefore, must be studied in the light of other symptoms; and as a diagnostic sign in ordinary cases it will be found to be most important very early in the case, though it may be highly characteristic of secondary accidents, such as a large subcortical hemorrhage breaking down the brain substance; or the supervention of a meningeal inflammation. It is the coincidence of at least some slight degree of meningeal or cerebral contusion which in a case of epidural hemorrhage occasions after reaction some rise of temperature; and it is the necessary co-existence of meningeal contusion with pial hemorrhage and of cerebral laceration with cortical hemorrhage which in these cases causes its still higher elevation.

The primary or earliest observable temperature has been found to be subnormal in a large percentage of cases, and practically normal in an almost equal number, and in neither case to be indicative of temperature to follow or of the final result. It may be merely one of the indications of a general shock in which an intracranial hemorrhage may or may not play a part. If such a hemorrhage exist as an influential factor, and reaction occur, temperature as already stated in the absence of intracranial contusion would rise to the normal degree and no higher; but with contusion it will continue to rise to some indefinite extent.

The rise may be progressive, or with recessions as circulatory and nutritive conditions vary, and in theory should always measure the extent of these altered conditions; that in fact it does not always do so is because these changes are not always the same in character. There is a possible exception to the rule, that some degree of contusion always accompanies intracranial hemorrhage, when with fracture of the vertex epidural hemorrhage is derived wholly from diplöic vessels.

This collection of cases cannot be said to confirm the theory of an existence of specific heat centres. If high temperatures have often been coincident with limited lesions which have involved regions described as specifically thermogenetic, they have equally characterized cases dependent upon lesions of every other part of the brain. The most extreme elevations and rapid progressions of temperature have been noted when with no localized injury there have been evidences of a profound general contusion. The extent and severity of intracranial injury rather than its limitation to any defined areas would seem in the light of clinical observation to determine excessive thermogenesis whatever its proximate cause.

It is not unsupposable that the primary subnormal temperatures may depend upon the abeyance of nutritive processes in the cerebral and meningeal cells in the first shock of injury, and that the subsequent excessive elevations may depend upon abnormally rapid destructive changes which follow the circulatory derangement.

The progressive rise of temperature which in so large a proportion of cases continues for thirty minutes or more after death, and sometimes to a remarkable extent, as a mere continuation of processes originating ante mortem requires no independent explanation. It is not observed after death from other forms of injury, but has an analogue in cases of Asiatic cholera.

ILLUSTRATIVE CASES.

Continued Subnormal Temperature.—See Case XXXIV.—*Consciousness.*

CASE XXXVII.—*Subnormal, Rising to Normal Temperature.*

Recovery.—The patient fell ten feet to a ship's deck; consciousness lost for twenty minutes; both pupils dilated. On admission to the hospital: stupor; temperature 97.6°; right radial pulse 92, and the left 100 in the minute; hemorrhage from the right ear and nostril; right pupil dilated.

Temperature and pulse became normal in three hours, and there were no further symptoms except frontal headache; no memory at any time of having been injured.

CASE XXXVIII.—*Subnormal, Rising to High Supranormal Temperature. Necropsy.*—An unknown man was seen to fall in the street and was taken by way of a police station to the hospital.

On admission: patient in profound coma; temperature 92°; pulse, 48 and weak; respirations, 40, shallow and almost imperceptible; small contusion over right parietal eminence and another over left mastoid process; no extracranial hemorrhages; left pupil much dilated, the right contracted, both immovable; right patellar reflex exaggerated; the left normal.

Five hours later: temperature 101.8°; pulse 80, slow and irregular; respiration 38, occasionally Cheyne-Stokes.

Second day: patient still unconscious; temperature 103.2°–103.6°; pulse 80; respiration 30; left pupil normal in size but still immovable.

Third day: pupils symmetrical, contracted, and without reaction; right external strabismus; face cyanotic; temperature 101.4°–104.6°; pulse 80–100; respirations 38–48.

Fourth day: cyanosis continued; temperature 103.2°–103.4°.

Fifth day: temperature 104°–106°; respirations 54–56; death; consciousness at no time regained.

Lesions.—Fracture extended from a point corresponding to external contusion, and internally from a point in groove for left lateral sinus at junction of sigmoid, across groove for superior petrosal sinus to left superior occipital fossa near median line; fracture linear; posterior wall of lateral sinus torn for three-fourths of an inch and still gripped in the closed fissure; blood extravasated from sinus formed a thick clot over whole left hemisphere anterior to occipital lobe and filled left posterior and middle basal fossæ; no cerebral laceration; excessive hyperæmia and œdema of whole brain including cerebellum.

CASE XXXIX.—*Normal, Rising to High Supranormal Tem-*

perature. Necropsy.—Ambulance history: coma; complete left hemiplegia; right pupil dilated and immovable, the left normal; hemorrhage from right ear.

On admission to hospital: symptoms unchanged; no superficial injury; temperature 98.8°; pulse 92; respirations 20. Later: loss of vesical control; temperature rising to 101.4°; momentary return to consciousness after twelve hours.

Second day: symptoms not materially changed; patient very restless; both pupils markedly dilated; temperature 103°–105.4°–104°–106°; pulse 144–120; respiration 45–50–20; one violent epileptiform convulsion.

Third day: extreme restlessness and widely dilated pupils; temperature 107°–109.4°. Death.

Lesions.—Linear fracture through right squamous portion, and along anterior surface of petrous portion of temporal bone to sella turcica; contusion of anterior surface of petrous portion; epidural hemorrhage from laceration of trunk of right arteria meningea media, with clot compressing whole lateral aspect of cerebrum, and escape of blood through squamous fissure into temporal muscle; laceration of left temporal lobe with moderate cortical hemorrhage in middle fossa; excessive œdema of entire brain including cerebellum, basal ganglia, and medulla; moderate serous effusion in left lateral ventricle and in subarachnoid space.

CASE XL.—*Primary and Continued Supranormal Temperature. Necropsy.*—A man was found unconscious a few hours after his return to his apartment, and was sent to the hospital.

On admission: fully unconscious; temperature 102.4°; pulse 92; respiration 36; no external injuries except some œdema behind the right ear, some small blood clots in nares and right external auditory meatus; pupils widely and symmetricallly dilated, and without reaction; superficial and deep reflexes absent; responded to painful sensations; lack of rectal control.

He survived seven days without regaining consciousness, except that he once or twice opened his eyes when disturbed, and continued to respond to painful sensations, as when a hypodermic needle was inserted. Rectal control was not restored; urine from the beginning was voided at regular intervals apparently without volition or consciousness; the pupils became normal in size and reaction on the fourth day; muscular spasticity which had been noted on admission continued in upper extremities, but disappeared in the lower on the second day; fluid nourishment was retained; temperature varied from 102° to 101.6° on the second and third days; from 102° to 101° on the fourth day; from 101° to 103° on the fifth day, and from 103° on sixth day to 107° at death on the seventh day; and was 109° post mortem; pulse varied from 74 to 100 and was 112 at the last; respiration was usually normal in frequency but was occasionally accelerated.

Incision failed to discover fracture. On the third or fourth day operation was suggested by other surgeons who saw the case, but the suggestion was not accepted in view of the early and later temperature conditions, although the existence of intracranial hemorrhage was recognized.

Lesions.—Fractures: one extending from right parieto-occipital region through middle fossa to foramen lacerum anterius, and a second extending from one optic foramen to the other through the sphenoid body; epidural clot filling right middle fossa and extending upward upon the cerebrum; numerous lacerations of left frontal and temporal convolutions and central gyrus, right frontal and parietal lobes, and both gyri fornicati; disintegration of superior surface of right optic thalamus; areas of limited contusion in various parts of both hemispheres; intense hyperæmia of entire brain and meninges.

CASE XLI.—*Moderate Temperatures not Measuring the Amount of Severe Cerebral Contusion. Necropsy.*—A woman, 60 years of age, fell down stairs and was at once sent to the hospital.

On admission: patient could be aroused to answer questions; irritable; temperature 99.6°; pulse 86; respiration 28; hæmatoma in left posterior parietal region; pupils normal; incomplete left facial paralysis, and slight twitching of both hands.

Second and third days: condition unchanged.

Fourth to ninth days: generally in stupor and unable to recognize her friends or surroundings; rational at times; very irritable when aroused; temperature varied from 99.2° to 100°; once rose to 101°; pulse 68 to 136; respirations 20 to 34.

Lesions.—Meninges hyperæmic; extensive subcortical laceration of right cerebrum from angular gyrus to descending cornu of lateral ventricle; several smaller lacerations nearer the base; brain œdematous; bloody serum in both lateral ventricles, and choroid plexus markedly œdematous; small hemorrhage upon floor of fourth ventricle; laceration in middle of right optic thalamus, and another in anterior part of right internal capsule; two small hemorrhages in left frontal lobe, and another larger just above anterior prefrontal space.

The relations of consciousness and temperature to the nature of the lesion as deduced from this series of cases and as apprehended by the writer have been more than once formulated, and are here restated:

The loss of consciousness,[16] which immediately succeeds a cephalic injury, is always the result of diffuse cerebral contusion; if unconsciousness is preceded by a conscious interval, however brief, or if after restoration of consciousness its privation soon recurs, it is occasioned by some form of intracranial hemorrhage. If, however, primary unconsciousness is permanent or greatly prolonged, its continuance may be due either to the severity of cerebral lesion or to a complicating hemorrhage; and whether the one has persisted from the beginning or been at any time replaced by the other, or whether both exist together, can be determined, if at all, only by a study of all the symptoms presented. The pulse, temperature, and respiration must be systematically recorded in every case from the first opportunity afforded for observation until the end . . . of these; the temperature in its course and variations will afford in the greater number of cases the most distinctive indication of the nature of the lesion . . . If, then, after the lapse of hours consciousness still remains in abeyance, a stationary temperature of but one or two degrees above the normal standard will indicate a hemorrhage of some profusion without serious cerebral injury; but a higher elevation which constantly increases, with possible recessions, will point to a visceral lesion. . . . The cases in which consciousness after brief restoration is again lost permanently, or for a lengthened period, have the same relations to temperature as those in which unconsciousness has been uninterrupted. It will be recalled that the recurrence of unconsciousness after an early interval of sensibility is indicative of an increase or supervention of hemorrhage, and that at a later period more or less conscious intervals in a general unconscious condition result from a lessening from time to time of the hyperæmia or œdema of a diffuse cerebral contusion. The question of hemorrhage should scarcely arise in the last instance, but the temperature still conforms to the general rule.

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[16] Phelps—"The Question of Early Operation in Cases of Intracranial Injury." ANNALS OF SURGERY, December, 1906.

III.—Pulse.—The examination of the pulse in 745 cases in which pulse and temperature had been systematically recorded afforded some results of importance. The classification of pulse rate and temperature here adopted is necessarily arbitrary, but may be considered as essentially correct.

Temperatures:
Subnormal, 98° and below.
Normal, 98° + to 99° inclusive.
Supranormal, 90° +.

Pulse rates:
Subnormal, below 70.
Normal, 70 to 80 inclusive.
Supranormal, above 80.

The following tables are constructed in view of pulse and temperature relations.

	Fatal Cases	Recoveries
Primary Subnormal Pulse:		
With subnormal temperature..........	36	30
With normal temperature..............	16	10
With supranormal temperature........	32	33
Primary Normal Pulse:		
With subnormal temperature..........	36	54
With normal temperature.............	21	41
With supranormal temperature.......	20	47
Primary Supranormal Pulse:		
With subnormal temperature..........	33	60
With normal temperature.............	36	53
With supranormal temperature........	86	101

The inferences which these figures justify are not essentially important, allowance being made for the greater number of recovering cases examined. Different combinations of pulse and temperature afford various percentages of subsequent deaths and recoveries; but the variations are not sufficient to form a basis for prognosis. Since these groups of cases necessarily merge along their lines of contact, a further comparison was made of cases as far removed from these lines as possible.

Subnormal Temperatures—97° to 92°.

Fatal Cases:

Pulse subnormal—Rate 68 to 46	15
Pulse normal—Rate 70 to 78	5
Pulse supranormal—Rate 100 to 144	5

Recoveries:

Pulse subnormal——Rate 56 to 66	5
Pulse normal—Rate 70 to 78	6
Pulse supranormal—Rate 100 to 144	14

Normal Temperatures—98.4° to 98.6°.

Fatal Cases:

Pulse subnormal—Rate 60 to 64	2
Pulse normal—Rate 70 to 80	9
Pulse supranormal—Rate 84 to 110	4

Recoveries:

Pulse subnormal—Rate 60	1
Pulse normal—Rate 76 to 80	7
Pulse supranormal—Rate 88 to 98	7

Supranormal Temperature—104.4° to 101.6°.

Fatal Cases:

Pulse subnormal—Rate 52 to 68	8
Pulse normal—Rate 0	0
Pulse supranormal—Rate 84 to 140	17

Recoveries:

Pulse subnormal—Rate 60 to 64	3
Pulse normal—Rate 70 to 80	4
Pulse supranormal—Rate 84 to 120	18

In all cases in which primary temperature was 102°, or above that point, the pulse rate was supranormal, at least 100 and usually much higher, except in certain cases of alcoholism, and in two others—one with embarrassed respiration and cyanosis and one which is inexplicable and will be included in the series of illustrative cases.

It does not appear from this later and more representative table that any practically important deductions affecting prognosis can be made from observations of the primary pulse. Generalizations are still found to be based upon differences in percentage too small to be of value. An exception to this general statement is in the fact that when temperature is not above 97° and pulse not above 66 death results in 75 per cent. of cases.

The primary pulse has some relation to the nature of the lesion. In cases of general contusion with or without laceration, but without hemorrhage of importance, it was normal, subnormal, or but slightly accelerated. If general contusion was accompanied by a considerable hemorrhage, usually pial or cortical, a supranormal pulse of 100 or more was so frequently encountered as to afford a fair presumption of such a complication of lesions. If the essential lesion was a hemorrhage it was usually epidural, and a subnormal or practically unaccelerated pulse was noted in 75 per cent. of cases.

Secondary Pulse.—In the progress of the case a discrepancy in the pulse rate and temperature elevation often become so marked as to be distinctive. This may occur at any period before the final stage when a decided acceleration of the pulse and elevation of temperature are usually coincident.

In the histories of 132 of the fatalities and of 201 of the recoveries in the second series of 500 cases, the records of pulse and temperature were sufficiently preserved to illustrate this abnormal relation. In 35 of the fatalities and 72 of the recoveries, 26 per cent. and 35 per cent. respectively, the pulse rate was normal or subnormal when the secondary temperature was above 100°; and in about one-half of these it decreased progressively as the temperature rose from the primary or immediately previous observation. Additional cases in which equally high temperatures are associated with a pulse rate somewhat above but approximately normal, as from 80 to 90 in the minute, materially increase the percentage of nonconformities of pulse to temperature and confirm an impression derived from superficial clinical observation. Such characteristic want of correspondence between pulse and temperature is not observed in the course of any other form of injury or disease.

There are still other cases in which though the temperature, pulse and respiration are in harmony and practically normal, they are all at variance with related conditions. The patient suffering from the shock of serious injury may be supposed to have a subnormal temperature, feeble rapid pulse, and shallow or sighing respiration; but it sometimes happens that with a cerebral lesion, and with a cold, moist surface, and other recognized symptoms of shock, there is no disturbance of either temperature, circulation, or respiration, or at most some diminished tension of a pulse of normal frequency. In more frequent instances, though the essential element of surgical shock or collapse is an impairment of the vasomotor system and circulatory failure, the pulse remains of normal or nearly normal character while the temperature falls. Whatever may be the explanation there certainly is in some cases a difference in the indications of shock or collapse as it results from intracranial, or from other traumatism. The presence of some phenomena of the more general depression and the absence of others, serve to specialize the primary effects of these particular lesions—perhaps by reason of special ganglionic centres involved.

A single case may be quoted in illustration of what might be termed cerebral shock, and incidentally of a pulse peculiarity to be mentioned a little later.

CASE XLII.—*General Shock with Normal Pulse, Temperature and Respiration. Recovery.*—A lad 8 years of age was crushed between a wagon and a fence, receiving no injuries except of the head. On immediate admission to the hospital he was in stupor, but could be aroused and then complained of nausea and vertigo. The skin was cold, pale and moist, the temperature 98.4°, the pulse 70, and the respiration 24. There was right facial paralysis, free hemorrhage from the right ear, contraction of the right pupil, and greater fulness and force of the right radial pulse than of the left. The external injuries were a wound in the left parietal, and a contusion of the right frontal region. During the first hour he vomited repeatedly. On the morning of the second day the pupils were both contracted, and in the evening they were both dilated, and he was delirious. His highest subsequent temperature was 101°.

At the end of the third week he had no symptoms remaining except some facial paralysis and dilatation of the pupils.

The want of conformity of pulse to temperature will be observed in many of the cases to follow. It will be found to be very marked in Case XXXVIII. The force and fulness of the pulse in general are not characteristic, and are as variable in intracranial as in other traumatisms.

Asymmetry of Opposite Radial Pulsations.—There is another pulse condition which is peculiar to this class of injuries. This is usually a want of correspondence in the force and fulness of arterial pulsation upon opposite sides of the body, and usually noted at the wrists. The increased tension is often wanting, and in rather exceptional cases the pulse rate differs while force and fulness may or may not remain the same. The frequency with which these aberrations occur is at the present time impossible to say; but the frequency with which they are noted seems to depend upon the care with which symptomatology is studied. It is probable that they can be discovered in a large minority, if not in the majority of cases in which opportunity is afforded for early and frequent observation. The summary of this subject made for the earlier collection of cases (Phelps, "Injuries of the Brain," p. 122 *et seq.*) requires little modification for the present larger number, and is reproduced with only slight modifications.

The want of symmetry in opposite radial pulsations was first recognized in the prosecution of that work in May, 1893, and since then has been found to exist in a considerable proportion of the cases in which it has been sought. It is most frequently a primary aberration, but may not occur until the second day or even later. It is sometimes transient, disappearing in a few hours, sometimes intermittent but oftener continuous for some days if the patient survive. The bilateral variation usually attaches to strength and fulness of the pulse, or to its fulness alone, while in other respects the pulse is symmetrical with its fellow. In some instances the fulness and strength of pulsation upon one side are in startling contrast to its weakness and tenuity upon the opposite; in others the difference is slight, and to avoid the possibility of error if doubt existed was excluded from the record. The original characteristics of each radial pulse are ordinarily retained so long as a difference exists, but such are occasionally interchanged.

The stronger and fuller pulse has been found on the right side rather more frequently than on the left. It was observed on the first day in about 75 per cent. of cases, and while its later recognition may have been due in some instances to earlier neglect, in others primary symmetry was positively known from careful observation.

It has occurred in both fatal and recovering cases, but much more frequently in the former, 70 per cent. or more, and in the latter has almost always been in those of a serious character. The pulse has been usually of good force at both wrists, though exceptionally it has been weakened, and on one side even imperceptible. In one instance, perhaps anomalous, the left radial pulse was full and strong and the hand warm, while the right pulse was feeble and the hand cold. In a single instance, also exceptional, the smaller pulse had the greater tension. The opposite pulse rates only occasionally differed and then not to exceed eight or ten pulsations to the minute. This discrepancy occurred both as an independent phenomenon, and associated with the other asymmetric conditions.

The necropsies have disclosed all forms of hemorrhage—epidural, pial and cortical—variously situated; lacerations of all lobes and of basal ganglia; and always with some degree of contusion which was sometimes the essential lesion. There were hemorrhages without laceration, and contusion without hemorrhage. The inferential lesions, those indicated by symptoms but not demonstratable later by direct inspection, were no less diversified. When limited lesions were discovered, the fuller and stronger pulse had been on the opposite rather than on the same side in a proportion of nearly two to one. There were limited lesions on both sides of the brain, or only a general lesion in a fair proportion of cases.

It is impossible, therefore, to infer the character or location of lesions from this sympton; it is equally so from any correlation which may exist between it and other symptoms by which it is accompanied. A fact important in another connection is that it is almost if not quite always associated with an abnormality of the pupils or a loss of vesical control.

ILLUSTRATIVE CASES.

CASE XLIII.—*Primary Asymmetrical Pulsations. Necropsy.* —A man fell fifteen feet and then walked across town to the hospital. After admission he had a chill which lasted nearly two hours, and was practically unconscious until death five hours later. The right pupil was widely dilated and without reaction and the orbital region was markedly ecchymotic. Pulsations of the left radial and brachial arteries were strong and full, and were very weak and small in the corresponding arteries of the right side. Four hours after admission temperature had risen from 98° to 104.6°, pulse from 40 to 64; and respiration had fallen from 36 to 32. Temperature at death was 105° and thirty minutes post mortem was 105.4°.

Lesions.—Fracture through right middle fossa involving the temporal bone and the greater wing of the sphenoid, and lacerating the anterior branch of the middle meningeal artery; firm epidural clot occupying right middle fossa and extending over temporal lobe; small laceration of opposite temporal lobe; small extravasation into the pons; and small contusion in left Sylvian fissure. The right temporal lobe was flattened laterally and inferiorly, and when the epidural clot was removed the brain retained its position widely separated from the middle fossa—including the outer half of the anterior surface of the petrous portion of the temporal bone. The small superficial cerebral vessels were distended, and the surface between them, at first pale, was soon reddened by a blush generally diffused. The surfaces of cerebral section soon became deeply reddened and bathed in watery effusion.

CASE XLIV.—*Primary Asymmetrical Radial Pulsation. Death.*—A child 2 years old fell two stories. The temperature on admission to the hospital was 100°; pulse 126; respiration 36. The right pulse was small, rapid, and irregular, the left only faintly perceptible; the pupils were dilated and the patient was unconscious. There was marked tonic contraction of the flexors of the fingers and extensors of the forearm, and later general convulsions which continued until death in the evening of the same day.

Incision made soon after admission disclosed extensive comminuted fracture of both parietal, both temporal and right occipital bones, and laceration of left posterior parietal lobe.

CASE XLV.—*Alternating Asymmetrical Radial Pulsation. Recovery.*—A man who had been found unconscious at the foot of a flight of stairs was admitted to the hospital with temperature 96.4°, pulse 66, and the right radial pulsations much fuller than the left. The respiration was irregular, sighing and chiefly abdominal; the left pupil was dilated and without reaction, the right contracted and responsive; the muscular system was completely relaxed; the urine was retained and the clothing stained with fæces. Hemorrhage from the right ear was constant and profuse, and there was blood in both nostrils. Some consciousness was soon regained and pupils became contracted and both responsive. The right radial pulse remained fuller and stronger than the left till the fourth day when the left became the fuller and stronger; and on the fifth day it was again the right, and on the sixth day radial pulsations were symmetrical. On the ninth day the radial pulse was once more the fuller and stronger, and on the tenth day pulsations were again symmetrical. The right radial pulse continued the stronger from the eleventh day, but on the twenty-third it differed but slightly from the left, and afterwards no difference was perceptible and all general symptoms ceased. The progress of the case was otherwise interesting. The temperature rose on the second day to 102°, and there was a discharge of sanguinolent fluid and of disintegrated brain matter from the left ear, which on the third day was a simple oozing. The patient on the second day was exceedingly voluble and afterwards had occasional delusions of locality. Dilatation of the left pupil was persistent and was accompanied at times by left internal strabismus. The temperature became normal three hours after admission, then at once rose to 101.8°, and continued at high degrees, often above 103°, till the thirteenth day and afterward was below 100°. The pulse rate was usually normal after the second day but occasionally rose to 100 and once fell to 44. The respiration was usually from 20 to 24 but at times subnormal.

Case XLVI.—*Secondary Asymmetrical Radial Pulsation. Recovery.*—A man who had been struck by a trolley car was admitted to the hospital still unconscious: Temperature 99.4°, pulse 70, respiration 18; pupils symmetrically dilated and without reaction; internal strabismus; radial pulsations symmetrical; reflexes normal.

Fifteen minutes later the pupils contracted, and the strabismus disappeared. Twelve hours later urine was retained. On the second day he was conscious and rational and vesical control was restored. On the third day the left radial pulse was fuller and stronger than the right; and on the fourth day radial pulsations were again symmetrical. No further symptoms.

Case XLVII.—*Secondary Asymmetrical Radial Pulsation. Necropsy.*—The patient, whose manner of injury was unknown, was found in the street, conscious, slightly delirious, and with hemorrhage from the nares. On immediate admission to the hospital his general condition was unchanged and his temperature was 102°; his pulse 68, and his respiration 20. On the second day his pupils were contracted, his right pulse was weaker than the left, and his temperature rose to 105°. On the fourth day rectal and vesical control was lost and he was stupid and drowsy. He survived until the sixteenth day and consciousness was retained till the last twelve hours. His mental condition was variable; usually stupid, drowsy, irrational, restless, and at times delirious. Rectal and vesical control were not regained; the pupils were dilated and at times widely so; temperature usually high, varied from normal to 104°, and at the end was 105.4°. The asymmetry of the radial pulsations continued, and as late as the thirteenth day the greater fulness and force of the left pulse was noted.

Lesions.—Fracture confined to the right orbital plate; no hemorrhages; no lacerations; intense hyperæmia and moderate œdema of the brain substance.

Case XLVIII.—*Secondary Asymmetrical Radial Pulsation Including Frequency. Recovery.*—A man who had been struck with a bar of iron was at once admitted to the hospital, conscious, irrational and alcoholic. Temperature 99°; pulse 88; respiration 20. There was a lacerated wound over the parietal eminence and no other symptoms. On the second, fifth and seventh days the right radial pulse was fuller and more compressible than the left. On the third day the left pulse was 76 and the right 72, and on the sixth day respectively 84 and 79 in frequency. Left facial paralysis was manifest on the second day, and still existed in very slight degree when discharged from the hospital. The pupils were normal and rectal and vesical control was retained. Temperature rose to 103° on the fourth day with normal pulse and respiration, and to 102.4° on the eighth day with pulse and respiration still normal. On the twelfth day temperature was 98.6°, and there were no symptoms.

Case XXXVII affords an example of unequal pulse rates with pulsations otherwise symmetrical.

Case XLIX.—*Discrepancy in Local Temperatures and Asymmetrical Radial Pulsation. Recovery.*—A man fell eight or nine steps down a stairway. On admission to the hospital he was in coma with a profuse hemorrhage from the left ear which continued two hours. The pupils were unequally dilated; the right radial pulse was feeble, and right hand cold; the left pulse was full and strong, and the left hand warm; and there was no apparent external injury. Consciousness returned gradually and was complete in six hours; the mental condition was then normal. There were no subsequent symptoms except severe left frontal pain and a sense of fulness in the head. At the first observation made five hours after admission, the temperature was 104°, the pulse 96, and the respiration 36. Later in the same day the temperature was 100°–103°, pulse 96–138, respiration still 38. Afterward the temperature was 99° and pulse had no noticeable peculiarity.

No definite relation was found to exist between intracranial tension and the general arterial pressure which might remain normal or be either increased or diminished, or might vary in the progress of an individual case. The cases selected for examination as to this relationship were such as well indicated the increase of intracranial tension by some of its characteristic symptoms, as loss of consciousness, high temperature with infrequent pulse, pupillary disturbances, and lack of rectal and vesical control. Arterial pressure was increased in a small minority of cases, markedly lessened in a much greater number, and normal or slightly lessened in the great majority.

IV.—Respiration.—The respiration in ordinary cases is not characteristic. In general, it is oftener than otherwise moderately accelerated in the beginning, and in fatal cases, as with other injuries and disease, becomes very frequent towards the end. In recovering cases which are not greatly prolonged there is not usually a notable acceleration; and whatever the issue is to be, even with primary general shock, it is often primarily normal. Peculiarities of rhythm occasionally occur, and stertor, sometimes a symptom, is less frequent than usually supposed.

There is, however, a class of cases in which respiration is diagnostic. In these it may be shallow with cyanosis and pulmonary œdema; or it may suddenly cease, or be progressively retarded until there are not more than one or two respiratory acts in the minute. In either event there is subdural hemorrhage, pial or cortical, in one or both posterior basal fossæ. Indirect pressure exerted through the dura mater by an epidural hemorrhage does not produce the same result. The phenomena in the first instance seem to be due to direct pressure upon the intracranial portion of the pneumogastric nerve. It is of course assumed in diagnosis that cases are to be excluded in which with cardiac failure bronchial râles are formed *in articulo mortis*. In the second instance pressure is made upon the respiratory ganglia either by a limited clot or by the mass of fluid blood extravasated. These pressure conditions may occur separately or together, and cyanosis may be the result of retarded respiration without the direct pulmonary lesion. In one case noted there was no hemorrhage into the fossæ and the pressure upon the medulla was made by a clot formed from blood derived from the ventricles.

There is reason to believe that a clot sometimes begins to form upon the medulla and is later washed away by continued hemorrhage. This may serve to explain instances of very slow primary respiration which soon becomes and remains normal or frequent. Special reference was made to such a case in a previous consideration of this subject.[17] The respiration was five in the minute on first examination and subsequently ranged from thirty-six to forty-six till death. Small coagula found upon the medulla were thought to be probable "traces of a larger hemorrhage which primarily encroached upon its lateral aspect and at that time retarded respiration."

Compression of the medulla was noted in 34 cases, in 23 of which the nature of the lesion was made manifest in post-mortem examination. In five instances, all of gunshot wound, death occurred at once or in the ambulance without opportunity for observation of symptoms if any existed, but in each the identity of the fatal lesion was unmistakable. In 24 of the remaining 29 cases respiration was progressively diminished in frequency and in the 5 others its cessation was sudden. In all cases primary temperature was below or but slightly above normal; in nearly all, consciousness was lost on admission; and in more than one-half, respiration primarily was abnormally infrequent. The interference with respiration usually occurred, if at all, very soon after the injury was received, but was sometimes deferred for several hours, and in one instance until the sixth day. Death followed in from a few moments to a few hours, and as in asphyxia generally the cardiac pulsations continued for an appreciable time after respiration had ceased. Other subarachnoid effusions, inflammatory or simply œdematous, did not check the respiratory movements.

In the 23 cases subjected to post-mortem examination the usual complication of lesions existed, but the hemorrhage into the occipital fossæ was always present; and in a large proportion of cases a clot rested upon the medulla, and often with no other considerable hemorrhage. If the clot was absent the basal hemorrhage was large. The clot often extended over the pons, but when confined to that part, as was to be expected, it did not affect respiration.

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[17] Lib. cit., p. 101.

This peculiar respiratory default can hardly fail of recognition, and it can rarely be anticipated; but the fact that a serious intracranial hemorrhage has occurred may be obvious, and with it an abnormally infrequent respiration is to be regarded as suspicious. A lesser number of respirations than fourteen in the minute occurs in a few instances, and in nearly all of these it is the precursor of a fatal result, and probably indicates a medullary compression. On the other hand in nearly 50 per cent. of such compressions primary respiration was normal or abnormally frequent; so that while a primary infrequency of respiration may have some prognostic significance, its absence can have none.

While apnœa from direct compression of the respiratory ganglia may have no great prognostic or therapeutic value it is a definite symptom and result of intracranial injury and an integral part of its history, and as such still has a special interest and importance.

Peculiarities of respiratory rhythm, of which the Cheyne-Stokes is an example, are not confined to this class of injuries and when they exist are attributable to cerebral lesion.

ILLUSTRATIVE CASES.

CASE L.—*Progressive Retardation of Respiration. Necropsy.*—Ambulance history: coma; extreme shock; wound over left eye; right pupil contracted, the left dilated, and both immovable; no hemorrhages.

On admission to the hospital: patient unconscious; pupils as before; surface pale and cold; face slightly cyanosed; marked subconjunctival hemorrhage in both eyes; slight right exophthalmos; reflexes absent; lack of vesical control; hæmatemesis; temperature 98.2°, receded to 98°, and post mortem was 98.6°; pulse 69–120–90; respiration on admission, 14; in one hour, 12; in two and one-half hours, 9; in three hours, 5; in three and one-fourth hours, 3; two minutes later unchanged; three to ten minutes later still, 2; and *in articulo mortis,* ten minutes afterward, 1; cyanosis then extreme.

Lesions. —Fracture extending from floor of left middle fossa through both anterior basal fossæ, comminuting left orbital plate; thick epidural clot compressing laterally left frontal and temporal lobes; rupture of left middle meningeal artery at its bifurcation; pial hemorrhage in right posterior basal fossa with clot extending over pons and medulla; general hyperæmia and marked cerebral œdema; limited contusion of orbital convolutions.

CASE LI.—*Progressive Retardation of Respiration. Necropsy.*—Pistol-shot wound through right temporal fossa; permanent unconsciousness; unsymmetrical dilatation of pupils; left corneal reflex absent; urine retained; some pulmonary œdema; temperature 96.4° to 96° for five hours and later declined to 95.6°; pulse 85, 94, 80; respiration on admission to hospital, 14; for one and one-half hours, 12; in two and one-half hours, 10; in three hours, 8; in four and one-half hours, 6; in five hours, 4; and a few minutes later *in articulo mortis,* 2. Cardiac action said to have continued for three minutes.

Lesions.—Bullet severed right middle meningeal artery, passed through third right temporal convolution, and was lodged in the posterior part of the inner border of the right temporal lobe; small piece of bone driven in advance of the bullet found between the right lateral columns of the medulla; large mixed epidural and cortical clot filled middle fossa, spread over whole right hemisphere, and thickly covered pons and medulla; hyperæmia of right hemisphere including basic ganglia of considerable intensity.

CASE LII.—*Abrupt Cessation of Respiration. Necropsy.*—Patient fell fifteen feet and struck his head upon the pavement. On immediate admission to the hospital: unconscious; hemorrhages from nose and mouth; orbital ecchymoses; slight laceration of left ear from which blood had trickled deep into external auditory meatus; right pupil contracted and immovable; left pupil dilated and feebly reacting to light; vomiting at intervals; patellar reflexes absent; hemiplegia and anæsthesia complete on right, and incomplete on left side and of right face; left face normal; temperature 99°; pulse 45; respiration 10. Twenty-two hours later temperature 101°; pulse 80; and respiration then normal ceased abruptly. Radial pulsations, 80 to 90 in the minute, and of good force, continued for an appreciable time afterwards.

Lesions.—No injury of scalp except some slight contusion of its deep surface in the left frontal region; left temporal muscle infiltrated with blood; fracture extending from a point in left parietal region directly above the ear across petrous portion and middle basal fossa into orbital plate which it comminuted; no epidural hemorrhage; thick cortical clot covering anterior part of left temporal lobe, from which a thin sheet of blood extended over whole left frontal and parietal lobes, anterior part of left occipital lobe, and first and second right parietal convolutions. Blood from left temporal region had also flowed through the Sylvan fissure, forming a clot which extended along the median line from a point anterior to the optic chiasm to the posterior border of the pons, and was a thick sheet over the left lateral half of that commissure. The hemorrhage was entirely derived from a single laceration which largely excavated the temporal lobe, and broke through the cortex at only a single point. The brain was moderately hyperæmic and œdematous.

The interpretation of the respiratory phenomena of this case is simple. The infrequent respiration on admission was due to primary cortical hemorrhage reaching the medulla, and the effect was transient because the pressure was relieved by the onward passage of the blood before coagulation. The final sudden cessation was the result of a renewed extension of hemorrhage over the medulla at the moment of death which again drained away into the occipital fossa.

CASE LIII.—*Late Respiratory Failure from Ventricular Hemorrhage. Necropsy.*—Patient fell down stairs and was at once admitted to hospital; no external injuries; coma; temperature 97.4°; pulse 60; respiration 16; hemorrhage from right ear, nose, and mouth; head and eyes turned to the left, pupils symmetrically dilated and without reaction, patellar reflexes exaggerated; muscles of both upper and lower extremities spastic, more marked on right side; loss of rectal and vesical control.

Later history: coma; muscular spasticity, loss of rectal and vesical control, and deviation of eyes to the left which continued until death on the third day. The pupils became contracted but were still without reaction, and the right radial pulse was fuller and stronger than the left, on the second day; and the respiration was Cheyne-Stokes on the third day; temperature on the second day was 97.4° to 102°, and on the third day 101° to 103°. The respiration just before death rather suddenly fell to 5 to 4 in the minute.

Lesions.—Fracture extending from right occipital fossa through groove for lateral sinus, and petrous portion of temporal bone; complete excavation of left frontal lobe, and laceration of right occipital lobe. Cortical hemorrhage over left anterior parietal region; fluid blood filled lateral ventricles and escaping through fourth ventricle formed clot upon the medulla.

CASE LIV.—*Gunshot Wound of the Brain with Immediate Death. Lesions.*—Bullet of 0.32 calibre furrowed base of frontal lobe, passed obliquely inward and backward, perforated temporal lobe between first and second convolutions, and perforated dura mater, fractured squamous portion of temporal bone, and fell back into the cerebral cortex; no epidural hemorrhage; cortical hemorrhage confined to the basal furrow and to anterior surface of pons and medulla.

(To be continued.)

SKIN GRAFTING AT THE JOHNS HOPKINS HOSPITAL.

BY JOHN STAIGE DAVIS, M.D.,

OF BALTIMORE, MD.,

Assistant Surgeon in the Out-patient Department of the Johns Hopkins Hospital.

THIS paper is based on a review of 544 house cases which have been skin-grafted in the clinic of Dr. Halsted at the Johns Hopkins Hospital. In this series all types of grafts have been used, and skin defects on almost every part of the body have been grafted.

Technic for Thiersch Grafting: Preparation of the Skin from which the Graft is to be Cut.—Shave the selected area and scrub carefully with green soap and water, and rinse with water. Sponge with ether, followed by 70 per cent. alcohol; then with Harrington's solution (bichloride of mercury, 9 gr.; hydrochloric acid, 60 c.c.; water, 330 c.c.; alcohol, 600 c.c.) and finally wash thoroughly with bichloride of mercury solution 1 : 1000. Again wash carefully with sterile normal salt solution, and apply a sterile gauze dressing, wet with normal salt solution until ready to cut the graft. (When Harrington's solution is omitted use 95 per cent. alcohol and continue as above.) The grafts are almost always cut from the thigh, and usually from the right one when practicable. The anterior and inner portion is the first choice, the external aspect next, and finally, if necessary, the posterior portion. Occasionally the skin from the arm or leg is used.

Cutting the Graft.—Place a small sand-bag beneath the thigh in order to give a better surface from which to cut. Arrange the usual sterile dressings about the selected area. Care must be taken that no carbolic or bichloride solutions be brought into the field or touch the grafts, either on the dressings, gloves, or instruments.

The Catlin knife and the boards after being boiled are placed in salt solution, and the sterile rubber protective is removed from the bichloride solution, and also put in salt solution.

The skin wet with salt solution is then put on the stretch, and held as flat as possible by means of two sterile boards about 8 inches long, placed quite close together at right angles to the length of the limb, the first being held by the assistant, and the other by the left hand of the operator.

The edge of the sharp Catlin knife is then engaged in the skin between these boards and held almost flat against the limb (Fig. 1), and by a rapid sawing motion the graft is cut, the knife closely following the board in the hand of the operator, which is drawn slowly along in front of it (Fig. 2). The graft is cut at a level which will include the tops of the papillary layer of the corium, and only a slight amount of bleeding will follow.

After cutting the graft, it is picked up upon a piece of rubber protective, the raw surface being exposed. The whole is then placed upon a board and by means of a smooth instrument the graft is spread out evenly (Fig. 3). It is then covered with gauze wet in salt solution until the area to be grafted is ready. For several years the large grafts on the defects following operation on breast cases have been buttonholed here and there to get rid of air bubbles.

Application of the Graft.—Being sure that all bleeding has ceased, the protective on which the graft is spread is placed over the defect so that the graft is next to the wound. Then gradually the protective is lifted up and the graft is separated and left in place. It is pressed down evenly on the wound with pieces of gauze in order to get rid of any air bubbles, and to make it adhere as closely as possible. Should more than one graft be needed, they are placed so that they slightly overlap the edges of the wound and of the adjacent grafts.

Preparation of the Surface to be Grafted.—If the graft is to be applied to a clean fresh wound it is important to see that all hemorrhage has ceased, and that the wound is as dry as possible. If a granulating wound is to be grafted, it is only necessary that the granulations be in a perfectly healthy condition before the grafting is attempted.

In a few cases the grafts have been applied directly to the healthy granulating surface after cleansing this surface as thoroughly as possible with irrigations, gauze pledgets, and wet compresses, being careful not to cause any bleeding. Lauenstein's method of rubbing off the granulations with sterile gauze tampons has also been used, but usually the granulations were thoroughly removed with a curette or scalpel down to the firm base, and the grafts applied. In addition to the above the unhealthy skin edges were excised and gridiron incisions made through the hard fibrous base of the ulcer to healthy tissue beneath, extending out into the normal surrounding skin, in order to obtain a better blood supply. In some old chronic ulcers the entire ulcer, including edges and base, was excised down to healthy tissue and the graft then applied.

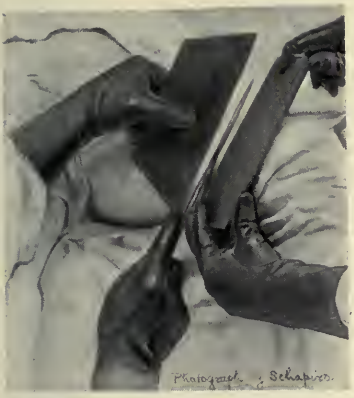
Dressing of the Grafted Surface.—Since April 10, 1895, when sterile silver foil was first applied in this hospital as a dressing to the grafts, it has been used almost exclusively, and with excellent results. It is put on in several layers and over the last layer are placed the porous sheets of paper which come between the silver leaves. This dressing allows the secretions to come through and be absorbed by the gauze which is placed above it. The dressing is secured by a bandage and the part immobilized. The first dressing takes place ten days later.

Dressing of the Area from which the Graft is Cut.—All sorts of dressings have been tried, but the one finally adopted as the most satisfactory and comfortable is sterile boric acid ointment spread on sterile rubber protective. This dressing extends some distance beyond the margins of the wound and is held in place by strips of adhesive plaster, and over this is put a dry sterile gauze dressing and a bandage.

By the method above described the largest and most satisfactory grafts can be cut, but this requires a skilful hand and constant practice.

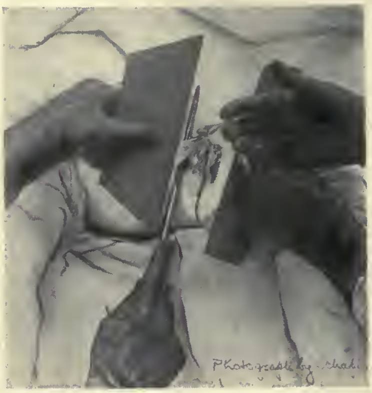
In the following statistics I have used this classification:

FIG. 1.



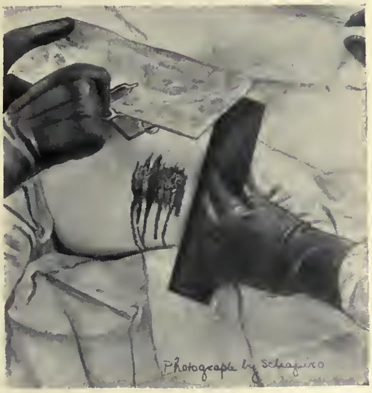
The boards in place, close together, holding the skin flat and on the stretch, with the Catlin almost flat against the thigh.

FIG. 2.



The graft being lifted up as the cutting proceeds, and the knife following closely the board in the left hand of the operator, the other board remaining in its original position.

FIG. 3.



The graft being spread out, raw surface uppermost, on a board covered by rubber protective.

autodermic, where the graft is obtained from the same individual; *isodermic,* where the graft is obtained from another individual of the same species; *zoödermic,* where the graft is obtained from a lower species.

In the cases reported here, the large majority have been those in which it seemed best to use thin grafts, this being especially called for in covering the defect in the skin left by a complete breast operation. Most of the grafts were obtained by the modified Thiersch method as described above; a few by Reverdin's epidermic method; and one or two by Lusk's blister method. Comparatively few thick grafts have been used, only 21 cases in all, 12 being whole-thickness sessile flaps, and 9 whole thickness pedunculated living flaps, from a distant part. Sliding plastic flaps from the adjacent skin were used when possible, and the defect immediately covered with a Thiersch graft. A number of cases have been grafted in the out-patient department whose records I have been unable to obtain.

The ulcers following breast operations were allowed to heal by granulation until July 6, 1896, when one was grafted for the first time by Dr. Bloodgood. On October 5 of the same year a partial immediate graft was tried at the time of the operation, also by Dr. Bloodgood; and since that time practically every defect following a breast operation in which the skin edges could not be approximated has been grafted with a complete immediate graft.

The graft was spread on protective first on March 7, 1896, which procedure greatly facilitates placing it in position. The attempt is always made to cover the defect with a single graft, consequently very large single grafts have been cut. The notes on the measurements of both defects and grafts to be covered are very incomplete, but the following taken after cutting may be mentioned: 8 x 10 cm., 8 x 12 cm., 8 x 16 cm., 10 x 18 cm., 12 x 12 cm., 16 x 16 cm., and 15 x 16 x 14 cm. (irregular shape). Results show that these larger grafts take as well as the smaller ones. Size of defect to be covered: 8 x 10 cm., 10 x 10 cm., 10 x12 cm., 11 x 11 cm., 12 x 12 cm., 12 x 14 cm., 14 x 14 cm., 15 x 15 cm., 20 x 20 cm., and 19 x 23 cm.

Thin Thiersch grafts of uniform thickness take better than those of varying thickness. Large grafts cannot be cut from a fat or flabby thigh.

Several recontractions have taken place under Thiersch grafts, especially those placed on the palm of the hand, and there seems to be no doubt but that a whole-thickness graft in this and other exposed locations would be more satisfactory.

Several cases of phlebitis of the long saphenous vein followed cutting grafts from the left thigh; and for this reason the right thigh is used whenever practicable, no case of phlebitis having yet followed cutting on this side.

In quite a number of cases black Thiersch grafts have been placed on white patients, and white grafts on black patients, with fair results. The pigment disappears or appears after a comparatively short time in Thiersch grafts, but there is no case in our series which will show the effect of the pigmentation of a whole-thickness graft thus transplanted.

When more skin than was required was cut, in several cases it was grafted on the wound from which it came with complete take.

What seems to be a failure at the first dressing will sometimes turn out very well, and *vice versa.* Some grafts are moist and there is considerable secretion throughout the healing process, while others are perfectly dry. In the moist variety a strong characteristic glue-like odor is often noticed. This moisture is probably due to secretions which are held back by the silver foil and paper, which becomes saturated soon after the operation, and then dries and forms an impermeable dressing, preventing the further escape of the secretions and also the ingress of air. Any one who has dressed grafted wounds covered with silver foil and paper will have noticed this fact in many cases, while in others the secretions do pass through and leave the wound dry. This latter is especially noticeable in those instances where alcohol is not used to moisten the paper in order to make it adhere more closely. In fact if the paper is used at all on these cases, which is unnecessary, it should not be moistened with the alcohol, both for the reason mentioned above, and also because the alcohol is injurious if it should soak through to the graft. It is best therefore to omit the paper and alcohol and to place dry gauze immediately next to the foil.

Too much pressure of the dressing on the grafted area may cause sloughing of the freshly applied graft, and a heavy dressing, causing too much heat and sweating, is to be avoided. In the majority of cases the wound caused by the cutting of the graft is healed some time before the patient is ready to leave the hospital.

In this series I have counted as a single case all the grafting done on any one patient during that particular hospital admission. For instance, if the patient is grafted two different times, or has two defects grafted at the same time, both being complete takes, then this is called one complete take.

Should one graft completely take and the other partially take, then this would go under complete and partial takes, etc.

GENERAL SUMMARY.—Taking a general summary of the cases grafted we find that there were 286 breast cases, 88 leg ulcer cases, 85 miscellaneous ulcer cases, 76 contraction cases, and 9 defects following excision of keloids, etc., making a total of 544 cases, of which 383 were females and 161 males. The average age of the complete takes was 42 years, the youngest being 3 years and the oldest 79 years.

Variety of Grafts.—497 autodermic Thiersch, 13 isodermic Thiersch, 10 autodermic and isodermic Thiersch, 11 autodermic whole-thickness sessile flaps, 6 autodermic whole-thickness living flaps from distant parts, 3 autodermic Thiersch and living flaps from distant part, 1 autodermic Thiersch and whole-thickness sessile flap, 1 autodermic Reverdin and isodermic Thiersch, 1 autodermic Thiersch and Reverdin and isodermic Thiersch, 1 zoödermic, from dog. Altogether there were 40 cases in which isodermic Thiersch grafts were applied; 19 were complete takes, 16 were partial takes, and 5 were failures, thus showing that isodermic grafts are on the whole well worth trying. Nineteen thick grafts from distant parts were used: 10 whole-thickness sessile flaps, with 9 complete takes and 1 partial take; and 9 living flaps, with complete take of all of these.

Dressings.—Silver foil, 442; 52 gauze, wet with normal salt solution, covered by rubber protective; 21 rubber protective and dry gauze; 2 gauze, wet with bichloride; 1 olive oil and protective; 1 collodion and protective; 25 not stated.

Result of Grafting.—Complete takes, 341; 168 partial takes; 14 complete and partial takes; 1 partial take and failure; 3 complete, partial take, and failure; 17 failures.

Condition when Discharged from the Hospital.—Healed, 412; 115, with granulating wounds, for the most part small; 13, no discharge note; 4, died.

Using the 69 partial-take breast cases as the base number, we find that the average length of time in the hospital after operation, of breast cases with complete take of immediate skin graft, is about 20 days; of partial-take immediate graft is about 28 days; and where no graft was used about 35 days. The 69 complete takes were all discharged healed. Of the partial takes, 22 cases were healed, 44 cases had small granulating wounds, in 3 cases the result was not stated. Where there was no graft the great majority were discharged with a fairly large granulating area. These figures show that grafting such cases, even if not completely successful, hastened considerably the healing process.

Conclusions.—The general health of the patient must be taken into consideration when skin grafting is contemplated, and grafts to be successful must only be transplanted to healthy wounds. As a rule grafts do not take well on luetic individuals. No antiseptics must touch the flaps before or after cutting. A general anæsthetic is necessary in the majority of cases where large grafts are removed. It is best to cover the defect with a single large graft if possible, as the healing is just as satisfactory as if several small flaps were used, and the scar is much less. Silver foil immediately over the graft has proved its worth, but it is best to apply it without the paper and not to use alcohol. Temporary moist salt gauze dressings are also very satisfactory.

Grafting, even if only partially successful, in the majority of cases will shorten the time in the hospital and accelerate final healing. Partial grafting nearly always stimulates epidermal growth from the edges of the wound.

Autodermic grafts take somewhat better than isodermic, but isodermic grafts are much more successful than is generally supposed. When a black superficial graft is applied to a defect on a white person the pigment disappears sooner or later, and *vice versa.* The majority of Thiersch grafts, especially on breast cases, that I have examined were still adherent throughout the greater part of their extent. The shrinkage in the size of a wound after grafting is in some cases quite remarkable.

Contraction is prevented to a large extent by grafting, although it sometimes occurs, especially under Thiersch grafts on exposed positions, such as the palm of the hand. In such locations the whole thickness of the skin should be transplanted. Slough of the axillary flap in breast cases has little effect on the healing of the grafts, as in many of the complete takes there was slough of the flap, and in many of the partial takes there was no slough. Mild wound infection, such as pyocyaneus, seem to have little effect on the ultimate healing of the graft.

CYST OF THE ROUND LIGAMENT OF THE LIVER.

BY M. S. HENDERSON, M.B.,
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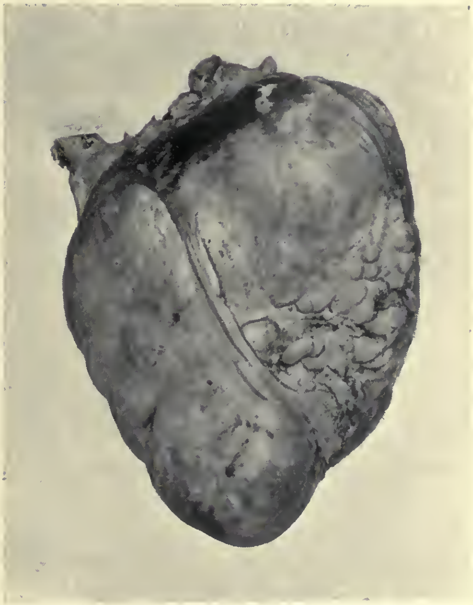
After a somewhat superficial search through the literature for data on the subject, the following report of a case is thought worthy of recording on account of its apparent rarity. Comparatively speaking, numerous references have been found of cysts of the round ligaments of the uterus but none of cysts of the round ligaments of the liver. This case is the only one of the kind that has been met with in the Mayo Clinic at St. Mary's Hospital.

E. A. M., male, aged 41, presented himself for examination January 13, 1909. His complaint was the presence of an abdominal tumor. The following history was given.

One morning, about eight years before, on attempting to straighten up after stooping to lace his shoes, he was seized with a violent cramp in the region of the umbilicus. He was unable to stand erect on account of the excruciating pain, and had considerable difficulty in getting to his bed. The pain gradually lessened, and after a good bowel movement, the result of an enema, he was free from discomfort. There was no nausea and no vomiting during the attack. This attack was the only one of the kind that he had; but his business affairs were exacting and his general health began to fail. Symptoms at this time were indefinite; he was treated for neurasthenia, and soon after, while being examined by his physician, an abdominal tumor about the size of a lemon was discovered, the exact nature of which was doubtful. Laparotomy was advised, but deferred. Under treatment for his nervous condition he improved, was able to resume his business, and as the tumor gave him no discomfort the operation was put off from year to year. The tumor gradually increased in size, however, until at the time of our examination it was about the size of a head.

FIG. 1.



Cyst of the round ligament of the liver.

Physical examination showed a rather thin, dark complexioned man. Heart and lungs negative, as were also the blood and urinary findings. On palpation of the abdomen a freely movable fluctuating tumor was to be felt. When left to assume the natural position, it was seen to be just to the right of the umbilicus and a little below it. It was not tender, there was no tympany over it, and it did not move with respiration. The movement downward was more limited than the upward and lateral movements, as it could be easily placed in either flank or be pushed up beneath the liver. A positive diagnosis could not be made, but an exploration was advised and accepted.

Operation, February 12, 1909, by Dr. W. J. Mayo: A median incision below the umbilicus was made, and upon opening the peritoneal cavity a straw-colored thin-walled cystic tumor about the size of a child's head presented immediately beneath the abdominal wall. The tumor was anterior to the omentum which was found tucked up behind it. Putting in the hand to explore for the site of the attachment, it was found to be intimately associated with the abdominal wall, just above the umbilicus. The incision was accordingly elongated to two inches above the latter, by which means the cyst could be partially delivered outside the abdomen. Gauze dissection was used in freeing it from its pedicle, causing very little hemorrhage, as there were no vessels of any size running to it. It was then seen that the cyst had its origin in the lower two inches of the round ligament of the liver, where the latter is closely attached to the abdominal wall. The cyst was removed without rupture. A photograph was taken which is shown herewith (Fig. 1).

The patient's recovery was uneventful. He left the hospital on the twelfth day, and for his home in three weeks from the time of operation.

HOUR-GLASS STOMACH.*

BY WILLIAM A. DOWNES, M.D.,

OF NEW YORK,

Associate Attending Surgeon to the New York Hospital; Assistant Surgeon to the
General Memorial and St. Francis Hospitals; Instructor in Surgery
Cornell University Medical College.

ALTHOUGH twenty years have elapsed since Bardeleben reported the first operation for the relief of hour-glass stomach, and nearly 200 operated cases have been recorded in the literature during this time, the obscurity often attached to the diagnosis, the difficulties to be overcome in the presence of marked adhesions and distorted anatomical relations and the final solution of the problem by applying the correct operative procedure, afford sufficient reason for calling the attention of this society to a single case which, in part at least, was of my own making.

N. T. Female, aged 33, was admitted to the General Memorial Hospital in the service of Dr. Wm. B. Coley (to whom I am indebted for the privilege of operating upon and reporting the case) December 11, 1906, with a typical history of acute perforating gastric ulcer. Operation seven hours after perforation. The opening, an unusually large one, was situated on the anterior surface of the stomach, midway between the lesser and greater curvatures, about five inches from the pylorus. It was surrounded by a thickened indurated area, one and one-half inches in diameter. The size of the opening (which would easily admit the tip of the index finger), the induration and the favorable location, made this seem an ideal case for excision, and, accordingly, an elliptical area measuring about three by two inches was removed. The incision was closed with chromic gut in the usual way, transversely to the long axis of the stomach. The suture line extended up to but did not encroach upon the lesser curvature. The abdominal cavity was not flushed, but a small pocket containing mucous and gastric contents situated between coils of intestine and omentum just to the left of the median line was swabbed out and a cigarette drain introduced through the lower angle of the wound. Drainage removed on fifth day. Wound healed without suppuration. The patient made a good recovery and at the time of her discharge from the hospital, January 17, 1907, had gained eleven pounds in weight. She soon resumed her work (that of a housemaid) and continued in excellent health, weighing, in July, 1908, 149 pounds.

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* Read before the New York Surgical Society, April 28, 1909.

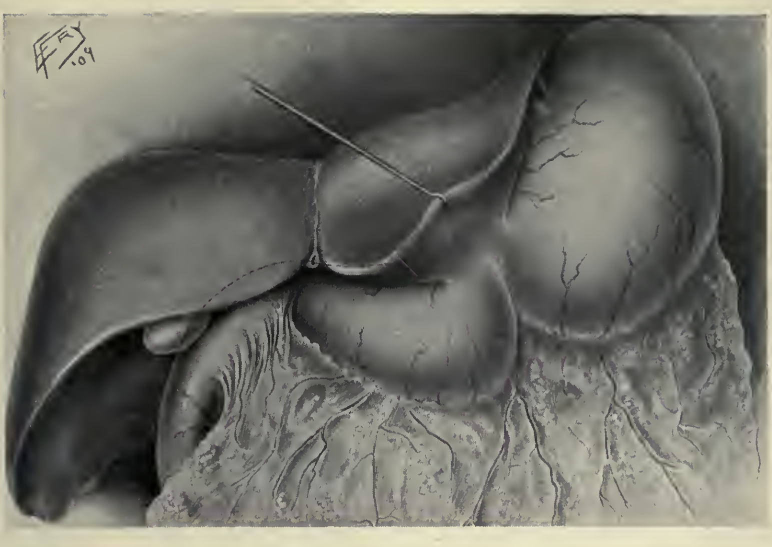
During the September following, that is three months less than two years after the operation, she began to suffer from "gas in the bowels" which was accompanied by a dull pain coming on about two hours after eating and extending from the left hypochondrium down to the umbilicus. Eating meat caused exaggeration of the pain and was usually followed by vomiting. These symptoms became progressively worse, and her decline was as rapid as had been her gain following operation. She was re-admitted to the hospital October 8, weighing 130 pounds. Lavage, dieting, and rest in bed, afforded slight relief to the symptoms, but did not check the loss in weight which had fallen during the subsequent three weeks to 117 pounds. Dr. Harold Barclay examined the stomach on four occasions during these three weeks with the following results:

Upon distention an unusually large cardiac portion could be readily mapped out, but the pyloric portion could not be distended. This was attributed to adhesions binding down this part of the stomach which in turn gave rise to the symptoms. On each of these occasions she had been given on the evening before a meal composed of a meat sandwich and from fifteen to twenty raisins. The washing at the first examination brought back 50 c.c. of stomach contents, consisting of meat and raisins. The washing at the second, as well as at the fourth examination, brought up nothing; at the third washing 120 c.c. were obtained. Hydrochloric acid present; no lactic acid. No blood in washings at any time. No tenderness in epigastrium. The possibility of hour-glass stomach was strongly considered, but "adhesions binding down the pylorus, with pyloric spasm" was thought to be the most likely diagnosis.

Operation, November 12, 1908. Gastrogastrostomy. Median incision from ensiform to the umbilicus. The greater omentum had been caught up on the abdominal wall at the site of the old scar, and had to be cut across before the stomach could be exposed. Then a tumor could be felt involving the stomach and liver, which at first was thought to be cancer; but after completely exposing the stomach this mass was found to be composed of dense adhesions binding the anterior wall and lesser curvature to the under surface of the left lobe of the liver. A typical hourglass stomach with a cardiac pouch about twice the size of the pyloric pouch, was disclosed (Fig. 1). The channel connecting the pouches would just admit the tip of the index finger plus the invaginated stomach wall. The cardiac pouch extended well up under the ribs and its wall was markedly thickened, while that of the pyloric portion was normal in appearance; the pylorus was not stenosed. The adhesion between the stomach and liver was so extensive and so completely organized, that it was out of the question to separate these structures; for this reason and the fact that the pouches could easily be approximated—in the presence of a patent pylorus—gastrogastrostomy was decided upon as the operation best suited to the case. This was easily accomplished with the aid of stomach clamps, and a three-inch vertical incision was so placed that the pouches communicated freely at their lowest points (Fig. 2). Convalescence rapid and uneventful. Discharged December 2, 1908, and returned to work four weeks later. At this writing, four months after operation, she weighs 146 pounds—a gain of 29 pounds—and can eat food of any kind without distress.

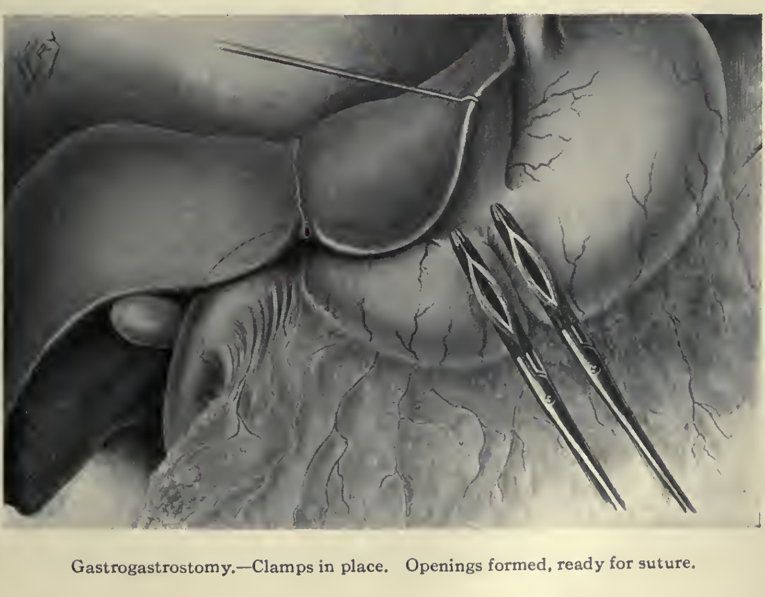
I feel that it is hardly necessary to venture the opinion that had posterior gastro-enterostomy been added to the original operation—and the patient could easily have stood it, the conditions requiring the second operation would not have arisen. As to the factors entering into the cause of the complication under discussion, not the least was the cigarette drain which had been so placed that it prevented proper descent of the omentum, with the result that this structure adhered to the abdominal wall throughout the lower half of the incision. In turn, the normal excursion of the stomach was limited, thus inviting the formation of perigastric adhesions. The constriction, involving, as it did, almost the entire circumference of the stomach at the junction of the middle and distal

FIG. 1.



Hour-glass stomach.—Margin of left lobe of liver retracted in order to show location and extent of the adhesion between liver and stomach.

FIG. 2.



Gastrogastrostomy.—Clamps in place. Openings formed, ready for suture.

thirds, was composed largely of cicatricial tissue which was undoubtedly just as important an element in the formation of the stricture as was the liver adhesion. Whether other ulcers were present and were overlooked at the time the one which perforated was excised, or the cicatrix resulting at the site of excision accounts for this scar tissue, I am unable to say. We know, however, from the writings of men best fitted to pass judgment on the subject, that ulcers which extend transversely to the long axis of the stomach, in the process of healing do lead to hour-glass stomach—in fact this is the most frequent cause. If you recall, the suture line in this case ran in that direction, and knowing, as we do, that any wound of the stomach or the intestine tends to contract, especially if in its closure a proper apposition of the mucous membrane is not obtained, I am therefore inclined to believe that the cicatrix was a factor in the formation of the stricture and that the suture line was wrongly placed. In the future, if I have occasion to excise an ulcer of the anterior wall, I shall make the incision parallel with and not transverse to the long axis of the stomach—as is the custom—first applying stomach clamps to control hemorrhage. I shall also dispense with drainage after operation in this region, except in the presence of an abscess or fistula, and then will see that the drain is so placed that it will interfere with the omentum as little as possible.

As to the second operation I am not sure, upon reflection, but that gastro-enterostomy would have just as well met the immediate indication and, at the same time, have been a safeguard against the recurrence of ulcer.

Frequency.—That hour-glass stomach is not of infrequent occurrence, is shown in every large series of cases of ulcer of the stomach examined both at autopsy and on the operating table. Grünfeld of Copenhagen, quoted by Veyrassat,[1] found the stomach to be the seat of an old ulcer in 124 out of 1150 autopsies, in 38—or 30 per cent. of which hour-glass contraction was present, the stenosis being too tight to admit the tip of the index finger in 8 cases. Moynihan[2] in 1905 reported 198 operative cases of chronic ulcer of the stomach, encountering hour-glass contraction 19 times, or in 9 per cent.

In 925 operations for ulcer of the stomach and duodenum, W. J. Mayo[3] says they have found hour-glass contraction 31 times, or in 3.3 per cent. of the cases. This is by far the largest single series of operations for ulcer yet recorded and probably represents very accurately the frequency of this complication in this country at least.

Etiology.—It was formerly thought that a considerable proportion, if not the majority of cases of hour-glass stomach, was of congenital origin. That this contention is incorrect, however, has been proven conclusively by the findings at operation. Ulcer, either active or healed, perigastric adhesions or cancer have been present in every case. Mayo Robson[4] states that in over 500 operations on the stomach he has not met with a single case of congenital hour-glass contraction. Only one undoubted case has been reported, according to Moynihan. Gardiner[5] has recently added a case to the literature, being that of a child three months old, in whom the condition was found at autopsy. As stated above, ulcer, adhesions or cancer have been so consistently present at operation that we are justified in attributing all cases to one or the other of these causes. Ulcer, as Veyrassat has well said, dominates the pathogenesis of hour-glass stomach. It may act by contraction of the stomach wall during cicatrization, or by setting up adhesions with the abdominal wall or adjoining structures, or finally by predisposing to the development of cancer. When biloculation results from cicatrization, the ulcer has usually originated either in the anterior or posterior wall or in the lesser curvature at or near the middle of the stomach and has extended transversely to its long diameter. As a rule, the puckering is at the expense of the greater curvature, but Moynihan refers to two cases in which the opposite condition was present.

Perigastric adhesions may form bands which constrict the stomach, or, more commonly, a given point on the stomach wall may become so fixed to the parietes, liver or pancreas, that biloculation will necessarily take place. These adhesions result in the majority of cases from an ulcer which has either perforated or extended down to the serous coat and become adherent to the peritoneum of adjacent parts. They may also follow injury or disease of adjoining structures, or operation involving this region. In the case herewith reported the adhesion to the liver was the direct result of operation.

Cancer implanted upon ulcer, or from whatever cause arising, situated at the points already mentioned, may lead to hour-glass stomach; however, again quoting Veyrassat, " this complication is merely an episode in the progress of the gastric neoplasm and is of consequence only as it concerns the treatment of that disease."

The constriction may be located in any part of the stomach, but most often involves the pyloric half, and, as a result, the cardiac pouch is the larger in the majority of cases. The relative size of the pouches and the thickness of their walls depend in a measure upon the calibre of the opening connecting them. A long, narrow channel results in a much dilated cardiac pouch with hypertrophied walls. If there is stenosis at the pylorus, which is not uncommon, both pouches become dilated and their walls thickened.

Robson and Moynihan[6] report two cases of double constriction forming a trifid stomach. One followed cicatrization of an extensive ulcer; in the other, an adhesion to the liver subdivided the cardiac pouch. The duodenum may also be the seat of hour-glass contraction. In the 925 operations for ulcer of the stomach and duodenum (about equally divided as to location), reported by W. J. and C. H. Mayo, hour-glass contraction was encountered 31 times—once in the duodenum and 30 times in the stomach. The same etiological factors no doubt prevail when the duodenum is the seat of this deformity as when it is located in the stomach, to which an added factor of no little importance would be periduodenal adhesions following inflammation of the gall-bladder and passages.

Symptoms of hour-glass stomach differ very little, if any, from those due to narrowing of the pyloric orifice. They follow, as a rule, in due time the preceding history of gastric ulcer. Taken alone the symptoms give no clue to the diagnosis, but if considered along with certain characteristic physical signs, will lead to a correct diagnosis in the majority of cases. Moynihan[7] says of his first 6 cases that only 1 was correctly diagnosed; but of the last 9, 7 were diagnosed with certainty. Naturally the signs of most value are those obtained from washing out the stomach and by distending it with gas. The following classification of the usual signs is practically that of Moynihan:

1. If a known quantity of water is introduced through the stomach tube and only a part is returned, the missing portion must have passed into a second cavity (Wölfler's first sign).

2. If the stomach is washed until the fluid returns clear and in a short time is again washed with the result that the fluid is returned dirty and perhaps foul smelling, it is evident that regurgitation has taken place from some connecting cavity (Wölfler's second sign).

3. After washing out the stomach and apparently completely emptying it, a splashing sound may be elicited, due to a portion of the fluid remaining in the pyloric pouch (paradoxical dilatation of Jaworski).

4. Upon passing in a quantity of fluid there may be distention of the cardiac pouch which gradually subsides to be followed by bulging in the pyloric region (Von Eiselsberg).

5. If the two halves of a seidlitz powder are given separately, and the stomach is auscultated, no loud forcible sounds are heard in the normal stomach except at the pylorus; if, however, constriction is present, the same sounds may also be distinguished to the left of the median line(Von Eiselsberg).

6. Moynihan first called attention in 1902 to a sign which has since been of great assistance to him in making the diagnosis of hour-glass stomach. The abdomen is carefully examined and the stomach resonance percussed. A seidlitz powder in two halves is then administered. On percussing after about 30 seconds an enormous increase in the resonance

of the upper part of the stomach can be found, while the lower part remains unaltered. If the pyloric pouch can be felt or seen to be clearly demarcated, the diagnosis is inevitable, for the increase in resonance must be in a distended cardiac segment. If the abdomen be watched for a few minutes the pyloric pouch may be seen to fill and become prominent.

7. On distending the stomach with CO_2 a distinct sulcus may be seen.

8. Radiography following the administration of bismuth mixture, gastrodiaphany and such measures may be of value in obscure cases, but are unlikely to be necessary.

The treatment of this condition is, of course, surgical, and the essential feature of any operative procedure as applied to a given case of hour-glass stomach, is that it shall provide complete drainage; failing in this the result will not prove satisfactory.

A careful examination of the stomach and its surroundings, with a full understanding of the cause and location of the constriction, is necessary in every instance, before a final decision is reached as to which method to employ.

The following operations have been resorted to in the treatment of hour-glass stomach, and when applied to suitable cases, either singly or in combination, will afford the desired relief: Gastroplasty; gastrogastrostomy or gastroanastomosis; gastro-enterostomy; partial gastrectomy (partial resection, annular mediogastric resection, pylorogastrectomy); dilatation. The dividing of adhesions has also been classed as an operation, and while it is apt to be a necessary adjunct to any procedure, may in a rare case of itself suffice.

Gastroplasty, an operation similar to pyloroplasty, was first used by Bardeleben in 1889. An incision, four or five inches in length, with its centre over the stricture, is made in the long axis of the stomach and is then closed in the opposite direction by two rows of sutures, the first including the entire wall and the second peritoneum and muscularis. Kammerer's[8] operation, a modification of the above, similar to Finney's operation for pyloric stenosis, is, according to Moynihan, the better operation. The use of the stomach clamp in Kammerer's operation as recommended by Gould[9] in his modification of Finney's pyloroplasty, would be of distinct advantage. Gastroplasty is indicated, if at all, only in thin-walled movable stomachs. It is contra-indicated when marked induration and extensive adhesions are present, on account of the difficulty in approximating the pouches and in getting stitches to hold, in active ulceration because it does not put the stomach at rest, and in all cases where the pylorus is stenosed.

Gastrogastrostomy or gastro-anastomosis consists in forming a vertical opening between the two pouches, so arranged that free communication will be established at their lowest points. The use of the stomach clamp has greatly simplified the technic of this operation, and, like gastroplasty, it is easy of execution, but has distinct limitations. It is permissible only in those cases in which the pouches are relatively large and sufficiently dependent to permit of their being easily approximated. As in gastroplasty, the pylorus must be open and the stomach free from active ulceration.

Gastro-enterostomy (posterior) should be the operation of choice in hour-glass stomach, for it best fulfils the essential requirement—drainage. Besides, by giving the stomach rest, active ulcers heal, and the chance of a recurrence is minimized. The anastomosis should be formed with the cardiac pouch, and only in those cases with co-existing pyloric stenosis is anything further necessary. In these it may be combined with either gastroplasty or gastro-anastomosis, or the suggestion of Weir and Foote[10] to unite each pouch to the jejunum by separate openings, may be adopted. In a number of instances on account of failure of the surgeon to properly examine the stomach before proceeding with gastro-enterostomy, death has followed as the result of forming the anastomosis with the pyloric pouch—that is distal to the obstruction. It may be permissible in rare cases where the stricture is high up in the cardiac half of the stomach to form the anastomosis with the pyloric pouch after manually dilating the stricture. Blake[11] reports such a case in which the result was excellent.

Partial gastrectomy is a more formidable operation than the preceding and should be reserved for those malignant cases in which a radical operation is justified and for indurated ulcers of a doubtful nature.

Dilatation is not a procedure to be recommended and should only be resorted to when, on account of adhesions or location of the stricture, other methods are impossible.

RESULTS.

All the cases reported up to August, 1908, have been collected by Veyrassat, with the following result:

Gastroplasty: 48 cases—36, or 75 per cent., cures; 7, or 14.6 per cent., failures; 5, or 10.4 per cent., deaths.

Gastrogastrostomy: 22 cases—15, or 68 per cent., cures; 3, or 13.6 per cent., failures; 4, or 18 per cent., deaths.

Gastro-enterostomy: 73 cases—57, or 72 per cent., cures; 2, or 2.7 per cent., failures; 14, or 19.1 per cent., deaths.

Six of the 14 deaths following gastro-enterostomy resulted from an error in technic—the intestine being united to the pyloric pouch.

Radical Methods.—(a). *Partial resection.* 3 cases—1 cure; 2 deaths.

(b). *Annular mediogastric resection:* 12 cases—11, or 91.7 per cent., cures; no failures; 1, or 8.3 per cent., deaths.

(c). *Pylorogastrectomy:* 2 cases—no deaths.

Combined Operations: 21 cases—4, or 19 per cent., deaths.

REFERENCES.

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[2] Moynihan: Abdominal Operations, W. B. Saunders, 1905, p. 664.
[3] Mayo, W. J.: Personal Communication, March 1, 1909.
[4] Robson, Mayo: Keen's Surgery, W. B. Saunders, 1908, p. 877.
[5] Gardiner: Jour. Am. Med. Ass'n., Nov. 9, 1907, p. 1598.
[6] Mayo Robson and Moynihan: Surgical Treatment of Diseases of the Stomach, second edition.
[7] Moynihan: British Medical Jour., Feb. 20, 1904, p. 414.
[8] Kammerer: Annals of Surgery, 1903, vol. xxxvii., p. 281.
[9] Gould: Operations upon the Intestines and Stomach, W. B. Saunders, 1906, p. 229.
[10] Weir and Foote: Med. News, May 2, 1896, p. 489.
[11] Blake: Annals of Surgery, 1903, vol. xxxvii., p. 280.

DIAGNOSIS AND TREATMENT OF CARCINOMA OF THE CÆCUM.*

WITH A REPORT OF TWO CASES TREATED BY RESECTION OF THE CÆCUM.

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In May, 1901, I published in *American Medicine* a report of a case of carcinoma of the cæcum, operated upon April 11, 1900. In condensed form the report was as follows:

Case I.—The patient was a woman of 38 years who gave a history of dyspepsia and failing health dating back some months. She had lost 40 pounds in weight, and was suffering from colicky attacks, with constipation becoming more and more pronounced. Five weeks before presenting herself for operation she first noticed in the right side a tumor which gradually enlarged. Upon examination a movable nodular mass, roughly the size of a split orange, could be grasped between fingers and thumb and pushed to the umbilicus or up into the right hypochondriac region under the free border of the ribs. Usually it lay in the right lower quadrant of the abdomen and had previously been mistaken for an inflammatory mass due to appendicitis, or a floating kidney.

Through abdominal incision, three inches long, in the median line, the tumor was delivered and found to be a carcinoma at the ileocæcal junction, mainly involving and nearly filling the cæcum. The head of the cæcum was invaginated, resembling a glove-finger pulled into itself as the finger is withdrawn, almost concealing an unusually long appendix. The omentum and mesentery were free, excepting a few mesenteric nodes which were found enlarged and were dissected out.

Gauze strips were passed through the mesentery around the ileum, about 4 inches from the cæcum, and around the large gut at the junction of the cæcum and ascending colon, and the strips tightened to control the circulation and occlude the lumen of the intestine. The tumor-bearing portion of intestine was then cut bodily from the mesentery, all vessels being caught and tied separately. The cut ends were closed by a Murphy button anastomosis of the ileum and transverse colon, made through a longitudinal slit in the transverse colon about 5 inches from the closed end of the ascending colon. The anastomosis was reinforced with an additional row of interrupted silk sutures. The peritoneal cavity was cleansed by irrigating with normal salt solution, and the abdomen closed.

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* Read before the Pathological Society of Rochester, N. Y., December 8, 1908.

The patient was given half-pint normal salt solution enemas every six hours till flatus was passed. The bowels were moved on the fourth day, and thereafter food was given sparingly for a week. The button was passed on the sixteenth day, and three weeks after the operation the patient went home.

The tumor and nodes were examined by Dr. H. U. Williams, Professor of Pathology, University of Buffalo. He reported the neoplasm to be an adenocarcinoma of colloid type. The enlarged nodes were not the result of metastasis, but were inflammatory and no doubt due to septic absorption from the fungoid ulcerating surface of the tumor within the bowel lumen (see Fig. 1). The tumor itself is about the size of a lemon. The specimen is in the Army College Museum.

April, 1909.—Since her recovery she has regained and has maintained her health and weight, and has borne two children in the nine years since the operation.

Case II.—Mrs. C., mother of three children; menopause at 45. Was 56 years old in August, 1907. Family history good. Health good until December, 1906, when her appetite became poor and bowels constipated. In July, 1907, she began to lose weight and fell away gradually till I saw her September 25, 1907, losing in all 20 pounds. In the early summer she discovered a lump in the lower abdomen. The constipation became more marked and she often had colicky pain with rumbling of gas. The lump grew larger slowly.

On examining Mrs. C., I found her anæmic and emaciated. Her heart and kidneys were not affected. The abdomen was distended in the right lower quadrant and peristaltic waves in intestinal coils moving toward the cæcal region were plainly seen. A mass somewhat irregular in outline and about the size of an orange was plainly felt in the right inguinal region, and on pressure the patient complained of tenderness.

On September 30 I operated, incising in the outer edge of the right rectus and exposing a freely movable tumor of the cæcum which was delivered onto the abdominal wall through an incision 4 inches long. The colon at the junction of the cæcum and the ascending colon having been clamped, the cæcum was cut away. Now the ascending colon was occluded by purse-string and inversion of the cut end. The same procedure was next done on the ileum about 3 inches from the ileocæcal junction. I then freely cut into the mesocæcum and mesentery, removing a wide triangular flap and removing all lymph-nodes which were demonstrable. I next made a lateral anastomosis between the blocked ends of intestine an inch from the closed ends. No drain was used. The patient made a good recovery, disturbed only by a subcutaneous abscess and cellular infection of colon bacillus type. She is at present (July, 1909) in good health and has gained 18 pounds within 22 months after operation.

Dr. H. U. Williams examined the tumor and pronounced it an adenocarcinoma of colloid type, mesenteric nodes showing no metastasis. He has mounted it for the college museum (see Fig. 2). The tumor was about the size of an orange.

In both tumors, proliferation of the neoplasm occurred mostly within the lumen of the cæcum, nearly filling the cavity of the gut and distending it to make a mass nearly as large as an orange. A rod as large as a lead pencil found its way with difficulty through the tortuous channel still present in each ileocæcal valve and the lumen of the cæcum itself. The rod shows in each figure.

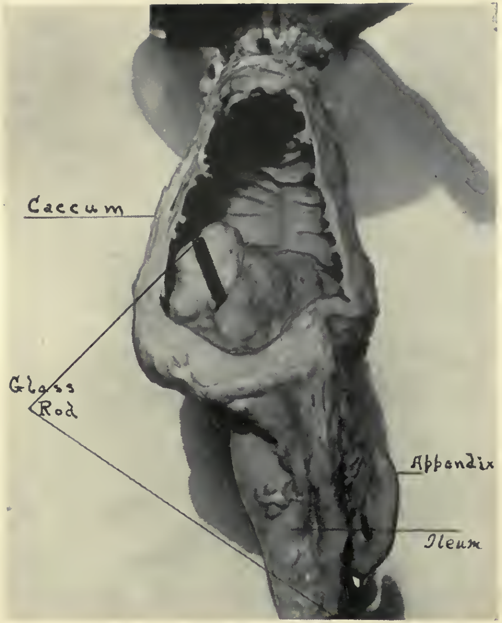
Cumston and Vanderveer collected 79 cases of cancer of the cæcum which they reported with 2 cases of their own, one being reported by each writer, in the ANNALS OF SURGERY for January and February, 1902. Of these operations 4 were exploratory openings of the abdomen. Excluding these exploratory operations, 33 of the remainder resulted fatally and 44 of the patients recovered—some with an artificial anus. The statistics of these operations in the years just preceding the publication were noticeably better than those of the earlier surgical periods.

Cumston and Vanderveer discuss entero-anastomosis after resection of the cæcum at length in their article, paying special attention to methods of enterorrhaphy to approximate the large open colonic end to the smaller open end of the ileum.

To me it seems wiser and easier to occlude the colonic end and make the lateral implantation of the ileum into the colon already described in Case I, or still better, to close both ends and make a lateral anastomosis between the blocked ends, as in Case II. A better circulation is insured by these methods for the anastomosis. Each cut edge of mesentery is free to recover its circulation, eliminating the so-called "dead space" at the mesenteric border which leads to leakage in end-to-end anastomosis. At the site of the anastomosis, a far better circulation is insured by either method. In the implantation only the cut end of bowel has had its mesenteric circulation impaired, and danger of leakage is lessened, while in a lateral anastomosis leakage occurs only as a fault in technic.

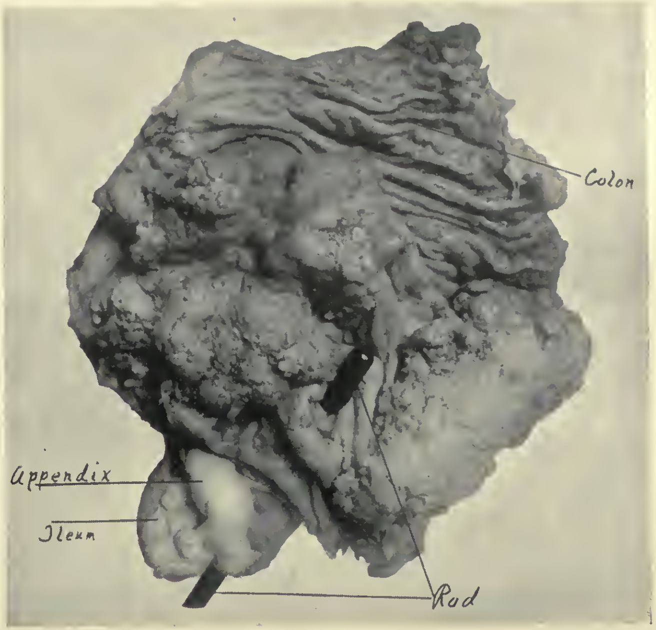
In cases of irremovable cancer of the cæcum, an ileosigmoidostomy or ileocolostomy is indicated to "short circuit" the diseased area, if bowel obstruction is imminent or present. If operation is done for patients suffering from obstruction of the bowel due to cancer of the cæcum when the patient's condition is such that a resection or a short circuiting by lateral anastomosis for irremovable cancer cannot be done at

FIG. 1.



CASE I.—Carcinoma of cæcum. From specimen in Medical College Museum. (Photograph by James A. Gibson, M. D.)

FIG. 2.



CASE II.—Carcinoma of cæcum. From specimen in Medical College Museum. (Photograph by James A. Gibson, M. D.)

the time, an artificial anus can be made. This procedure should only be considered, however, as a matter of necessity and a future operation to short circuit the disease and close the artificial anus should be done, if possible.

In reporting their own cases, Cumston and Vanderveer own to a diagnosis of appendicitis in one of them and to an exploratory laparotomy in the second—diagnosis being uncertain. Cumston removed the appendix in his case, and eight weeks later again operated to attack the true disease that had made itself more manifest by symptoms of bowel obstruction and palpable tumor. Vanderveer made an exploratory laparotomy to make his diagnosis which was obscured by the abdominal distention of complete bowel obstruction.

In discussing symptomatology, I include with the two operated cases three cases of inoperable cancer of the cæcum which I saw in consultation when too far advanced to be removable and which were not in need of operation to relieve obstruction.

In all my cases pain of a colicky nature due to mechanical interference with peristalsis, and most severe in the lower right side of the abdomen, occurring on several occasions, had caused the attending physicians to diagnose chronic appendicitis. In the first case a floating kidney was later diagnosed, when the large movable tumor was found.

In all of the cases the characteristic group of symptoms were loss of appetite, impaired digestion, loss of flesh and color, occasional diarrhœa, and, later, constipation increasing in obstinacy, accompanied by colicky pains most severe in the right lower quadrant of the abdomen. The patients had a low-grade septicæmia, temperature occasionally reaching 99.5 or 100° F.; slow pulse early in the course of the disease, and faster as weakness became more pronounced; no chills or sweats; hæmoglobin low.

Indicanuria, when present, is an indication of obstruction of the bowel, when considered with the symptoms already given. In Case II Dr. Abbott made two examinations of the urine before operation,—one six months before and one a few days before operation. Both showed indican increased. Repeated examinations since operation show no increase of indican.

No blood examination was made in Case I, but in view of the ulcerating interior of the tumor mass and the inflammatory lymph-nodes, a moderate leucocytosis could be readily explained, although a secondary anæmia was to all clinical appearance the most likely blood condition. In Case II, just before operation, Dr. Abbott found hæmoglobin 65, red cells 3,500,000, and leucocytes 8500—no differential count being made.

In none of my cases could a history of bloody or mucous stools be obtained; but it must be remembered that careful observation of evacuations is rarely made by patients. Dr. Abbott reports no blood found in his examination of the stool in Case II just prior to operation.

These signs and symptoms can be grouped under two headings: those of a low-grade septicæmia plus the toxæmia of intestinal putrefaction, and, secondly, those of increasing mechanical interference with peristalsis—that is, obstruction of the bowel.

Upon the discovery of a tumor the signs and symptoms just considered take on new significance. We may be dealing with tuberculosis of the cæcum, impaction of fæces, floating kidney, tumor of the kidney, chronic appendicitis, distended gall-bladder, or ovarian tumor. Cumston and Vanderveer mention also gastrectasis, gastroptosis, and carcinoma of the stomach. The picture of cancer of the cæcum heretofore given may be clear enough to make a differential diagnosis easy in many cases. In some, exploratory incision may be necessary to determine the diagnosis.

The length of time elapsing before the tumor mass actually does become palpable bears strongly on prognosis. Careful physical examination is often overlooked by physicians, or the new growth would be discovered earlier, beyond doubt, than actually does occur in most cases. In scirrhus forms of cancer the tumor may be progressive for many months before it becomes palpable or visible; or it may not be found till exploratory operation is done, or after death. In colloid forms it may appear much earlier,—within two months from the onset of symptoms, as in Case I, or within five or six months, as in Case II.

Cancer of the cæcum has come under my observation much less frequently than cancer of the sigmoid flexure or of the rectum. I have had 5 cases, of which 2 were operable and removable and are herein reported. My colleague, Clinton, has seen 3 cases, 2 advanced and inoperable and 1 which recovered after resection of the cæcum with end-to-end anastomosis of ascending colon and hypertrophied and distended ileum. The resection was done eight months ago, and the patient is at present in good health.

Sutton says carcinoma is more frequent in the lower than in the upper part of the intestines. In every 100 cases of intestinal cancer, according to him, 75 occur in the rectum, 23 in the large intestine and 2 in the small. Of the 23 cancers of the large intestine, 2 occur in the cæcum, 3 in the hepatic flexure, 4 in the splenic flexure, 10 in the sigmoid flexure, and 4 elsewhere in the colon.

If 2 per cent. of cancers of the intestine are cæcal in situation we must admit the need of considering this disease in all cases of chronic disease of the right lower quadrant of the abdomen. The earlier the diagnosis the more hopeful is the outlook after resection. My result in Case I is most encouraging, nine years of elapsed time being a most convincing proof of the complete removal and cure in this case of cancer of the cæcum.

All authorities agree that next to early diagnosis, surgical interference and wide and thorough operative removal is essential for a cure. Line of section should take an inch to two inches of healthy bowel with the growth if possible, and as wide a section of mesocæcum and mesentery as can be done without damage to the bowel circulation. Owing to the ulcerative process on the mucous surface of the growth, the lymphatic nodes are enlarged early in the disease from septic absorption rather than from metastasis of cancer, judging by my experience in two cases. Enlarged lymphatic nodes should be sought out and removed.

In the future I will choose for the operation in resecting the cæcum for removable carcinoma, inversion of both ends of the cut intestine followed by lateral anastomosis by the clamp method between the stumps, or between the stump of the ileum and the most accessible portion of the colon, preferably the ascending or transverse colon.

A review of the literature on this subject since the paper of Cumston and Vanderveer in January, 1902, in ANNALS OF SURGERY, was made for me by Albert Allemann, M.D., of the Medical Library of the Army Medical Museum, Washington, D.C. He adds 38 cases to the number which they report. I append to this paper a brief history of each case and the journal in which the report was made.

REPORTED CASES SINCE JANUARY, 1902.

SURMONT: Bull. Soc. centr. de med., Lille, 1902, 221. CASE I.—Male, 50 years of age. No previous history. Incision was made, but nothing done. Patient died six days afterward.

ANSCHUTZ, W.: Verhandl. d. deutsch. Gesellsch. f. Chir., Berlin, 1902, xxxi, pt. 2, 413. CASE II.—Male, 40 years of age. A few months before the first symptoms. Operation; death shortly after operation (sutures tear through). CASE III.—Male, 58 years of age. First symptoms a few months before. Operation: resection of cæcum. Death, twelve days after. CASE IV.—Male, 53 years of age. Two months before first symptom. Operation: removal of cæcum. Complete recovery. CASE V.—Male, 30 years of age. First symptom about a year before. Operation: removal of cæcum. Complete recovery.

LAMAS, A.: Revista médica de Uruguay, Montevideo, 1903, vi, 201. CASE VI.—Male, 30 years of age. Four months ago first symptom. Operation: nothing done, drainage; second opening: declared inoperable.

ATHERTON: Maritime Med. News, Halifax, 1903, xv, 174. CASE VII.—Male, 30 years of age. About year before began to have constipation. Operation: incision; more than a foot of bowel removed. Recovery.

BÉRARD: Lyon médical, 1903, c. 431. CASE VIII.—Woman, 30 years of age. First symptom five months previous. Operation: entero-anastomosis, on account of great weakness. Second operation: cæcum removed. Recovery.

BALLOCH, A.: Washington Med. Ann., 1903, ii, 12. CASE IX.—Male, 36 years of age. Cold. Three weeks before first, griping pains. Operation: cæcum removed with 3 inches of ileum. Good recovery.

REVERDIN, J. L. Rev. méd. de la Suisse romande, Genève, 1903, xxiii, 440. CASE X.—Male, 63 years of age. No previous history given. Removal of cæcum. Death on eleventh day.

Cestan: Toulouse méd., 1903, 2 S., v, 272. Case XI.—Woman, 52 years of age. Previous dyspepsia symptoms. Operation: "partial extirpation," cæcocolic entero-anastomosis. Recovery; "complete cure" was not intended.

Darling, C. G., and Loree: Med. Record, N. Y., 1903, lxiii, 938. Case XII.—Male, 46 years of age. First noticed swelling and pain eight weeks before. Operation: cæcum removed. Complete recovery.

No Author.—St. Thomas's Hosp. Rep., 1903, Lond., 1904, xxxii, 190. Case XIII.—Female, 58 years of age. Pain commenced three weeks ago. Operation: resection of 5 inches of ileum, cæcum and part of ascending colon. Patient never rallied; died on third day. St. Thomas's Hosp. Rep., 1903, Lond., 1904, xxxii, 190. Case XIV.—Female, 65 years of age. Five months previous diarrhœa and pain. Operation: resection of cæcum and small part of ileum; artificial anus. Death on twentieth day.

Frohwein, F.: Ein Fall von primärem Cæcum-carcinom. Kiel dissertation, 8°, Kiel, 1903. Case XV.—Male, 59 years of age. For a month past diarrhœa, etc. Diagnosis: inoperable carcinoma of cæcum. Operation for anus præternaturalis. Six days after patient died.

François-Dainville: Bull. soc. anat. de Par., 1904, lxix, 166. Case XVI.—Male, 32 years of age. Three weeks before pain. Operation: ileocæcal resection. Recovery.

Slaughter, R. M.: Virginia Med. Semimonth., Richmond, 1904–5, ix, 401. Case XVII.—Male, 46 years of age. Suffered from acute appendicitis. Operation: resection of cæcum; recovery.

Nehrkorn and Kapose: Beitr. z. klin. Chir., Tübing., 1904, xliii, suppl., 126. Case XVIII.—Woman, 64 years of age. Six weeks previous symptom. Operation: patient is weak, therefore anastomosis between ileum and colon. Recovery. Radical operation was not advisable.

Huppert, P.: Ueber einen Fall von primarem Gallertcarcinom des Cæcums. München dissertation, 8°, München, 1904. Case XIX.—Woman, 70 years of age. For thirteen weeks previous had to lie in bed on account of abdominal pains. Diagnosis: tumor of cæcum or omentum. No operation; death. Illinois Med. Journ., Springfield, 1905, viii, 3. Case XX.—Female, 25 years of age. Pains about one and one-half years before. Operation: cæcum with part of ascending colon removed. Recovered completely.

Plummer: Illinois Med. Journ., Springfield, 1905, viii, 464. Case XXI.—Female, 25 years of age. Pain four years, first symptom. Operation: removal of cæcum and part of ascending colon. Recovery complete.

Carless: Med. Press and Circular, Lond., 1905, lxxix, 648. Case XXII.—Woman, 65 years of age. Symptoms noticed only a few weeks before. Operation: ileocolostomy. Patient's condition did not permit a radical operation. Good recovery.

Wilson, C.: Mobile Med. and Surg. Journ., 1905, vii, 230. Case XXIII.—Male, 49 years of age. First symptom a few months ago. Operation: cæcum removed Recovery complete.

Depage: Journ. de chir. et Ann. soc. belge de chir., Bruxelles, 1905, v, 194. Case XXIV.—Female, 66 years of age. Year ago intestinal obstruction. Operation: anastomosis between ileum and colon; patient was weak. About a month later another operation, but tumor was found inoperable.

GIAUNI, V., AND ROLANDO, S.: Gazzetta degli ospitale, Milano, 1906, xxvii, 1523. CASE XXV.—Male, 61 years of age. About a year previous had pain. Operation: cæcum with 5 inches of ileum removed. Died five hours after.

DEL CASTILLO: Revista ibero-american de ciencias med., Madrid, 1906, xvi, 169. CASE XXVI.—Male, no age given. No previous history. Was not diagnosed until too late; was not operated. Death.

GAYET: Lyon méd., 1906, cvii, 840. CASE XXVII.—Female, 54 years of age. Three months ago first symptom. Operation: a cæcostomy. Twenty days later cæcum removed with tumor. Recovery.

ABERG: Hygiea, Stockholm, 1906, vi, 256. CASE XXVIII.—Female, 56 years of age. About two years ago first symptom. Operation: resection of cæcum and part of colon. Recovery.

SHEARS: Clinic, Chicago, 1906, xxxvii, 719 (Homœopathic). CASE XXIX.—Female, 52 years of age. Two years ago first pain in abdomen. Operation: excision of cæcum and anterior part of ileum. Recovery.

JONES, O. M.: Montreal Med. Jour., 1907, xxxvi, 449. CASE XXX.—Woman, 52 years of age. Complained of pain twelve months previous to operation. Operation: excision of cæcum; Murphy button. Recovered; did well for a year, but died twenty-one months after operation of "cancer of the blood." Postmortem examination showed no return in intestine. CASE XXXI.—Male, 42 years of age. Attacks of vomiting for a year previous. A surgeon removed appendix, and fistula formed. About two years later patient consulted author. Operation: cæcum with portion of colon removed. Recovered completely. CASE XXXII.—Male, 27 years of age. Pains commenced eight months ago. Removal of cæcum with mass of involved omentum. Recovered completely. CASE XXXIII. —Male, 61 years of age. Pains for six months previous. Operation: removal of cæcum and portion of liver (cautery). Died one month after operation. CASE XXXIV.—Male, 42 years of age. Pain sixteen months previous. Operation: resection of cæcum with lateral implantation of ileum. Recovered completely.

BAUBY AND PUJOL: Toulouse méd., 1907, ix, 219. CASE XXXV.—Male, 65 years of age. About six months ago first symptoms. Resection of cæcum. Recovery.

ATHERTON, A. B.: Canada Lancet, Toronto, 1908, xlii, 104. CASE XXXVI.—Male, 30 years of age. For a year previous crampy pains, etc. Operation: about 18 inches of bowel removed. Recovered completely.

LEREBOULLET AND DIXIER: Bull. et mem. soc. méd. d. hôp. d Par., 1908, 3 S., xxv, 397. CASE XXXVII.—Male, 56 years of age. Thirteen months ago he began to lose flesh, and had pain in right abdomen. Not diagnosed. No operation. Patient died. Autopsy: cancer of cæcum.

GIRARD: Rev. méd. de la Suisse romande, Genève, 1908, xxviii, 257. CASE XXXVIII.—Male, 45 years of age. For a year past violent pains in abdomen. Diagnosis: possible tuberculosis or cancer of cæcum. Operation: cæcum excised; Murphy button; complete recovery.

RESECTION OF THE COLON FOR CANCER AND TUBERCULOSIS.*

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THE following ten cases which have occurred in the last six years constitute my entire experience in resection and anastomosis of the colon for cancer and tuberculosis. I have excluded those cases of cancer of the upper rectum in which the sigmoid has been anastomosed with the lower rectum, as this operation is one of entirely different technic from that required for growths above the rectum. I have also excluded several resections of the small intestine up to the ileocolic juncture with lateral anastomosis between the ileum and the colon. I have eliminated a few cases where I have anastomosed the small intestine with the sigmoid for the purpose of side-tracking the colon. In other words, the discussion will be limited entirely to pure resections and anastomoses of the colon. Of these ten cases eight suffered from carcinoma and two from tuberculosis:

CASE I.—H. D.; male; 55 years of age; Pennsylvania Hospital. Diagnosis: *Acute intestinal obstruction; carcinoma of colon; thoracic aneurism and chronic endocarditis. Resection of descending colon and immediate anastomosis,* July 24, 1903. *Sudden death eight hours later.*

This man presented the appearance of having been a hard drinker. His abdomen was markedly distended, with no particular rigidity, pain or tenderness. He was nauseated but had not vomited. Bowels had not moved for five days, in spite of laxatives and enemata. The transverse colon was very much distended and could be easily made out. The abdomen was opened in the median line by an incision extending above and below the umbilicus. When the peritoneum was opened a dark-colored fluid escaped. The colon was first examined. It was found normal throughout, excepting just above the sigmoid flexure, where a hard mass could easily be felt. When this was delivered it was found to be a carcinoma, producing absolute obstruction. The abdominal cavity was filled with a quantity of dark fluid containing flakes of lymph. The carcinomatous mass, together with a proper amount of bowel, was resected; two glands were removed from the mesocolon and an end-to-end anastomosis, by means of two rows of silk sutures, was performed. A rectal tube was introduced well above the point of anastomosis; two strips of gauze were placed about the seat of anastomosis and the bowel returned to the abdomen. The cavity was then thoroughly irrigated and closed. A large quantity of gas and liquid fæces escaped through the tube. The operation occupied more time than it should have done, because of the difficulty in bringing the diseased bowel out through the median incision. In another such case I would feel inclined to make a second incision in the left iliac region. The patient did well after operation for about eight hours, when he was suddenly taken ill with cardiac symptoms and died. At the autopsy a large aneurism of the thoracic aorta was discovered, and Dr. Longcope, pathologist of the Pennsylvania Hospital, thinks that the cardiac condition present was sufficient to account for the sudden death. There were evidences, however, as there were at the time of the operation, of peritonitis.

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* The Annual Oration before the Philadelphia Academy of Surgery, delivered May 3, 1909.

Comments: In this case I should have made a second incision, done a colostomy and postponed the resection until later, or performed a resection and drained the bowel and made the anastomosis later. A lateral anastomosis would have been better than the end-to-end one which I did. Under the circumstances the overlooking of the thoracic aneurism would seem justifiable.

Pathology: Adenocarcinoma of colon; serofibrinous peritonitis; congestion of lungs; general arterial sclerosis; diffuse aneurism of arch of aorta; chronic aortic and mitral endocarditis; left-sided cardiac hypertrophy and slight diffuse nephritis.

Case II.—M. D.; female; 70 years of age; Pennsylvania Hospital. Diagnosis: *Acute intestinal obstruction; adenocarcinoma of colon. Resection and immediate anastomosis,* January 7, 1905. *Death twenty-third day after operation.*

I saw the patient first about nine o'clock on the day of operation, with Drs. Bennett and Musser; there was nothing in the previous history to throw any light on the cause of the obstruction. She had suffered from moderate constipation and had had some attacks of abdominal pain. She had always been very secretive about herself and it was difficult to get any satisfactory history. One noticeable point was that she had habitually restricted her diet to very simple things. She had not lost weight. For four days previous she had been unable to have a bowel movement and had become gradually more and more distended. The distention was more marked on the right side of the abdomen, but at no time was Dr. Bennett able to feel any mass. There had been no nausea or vomiting excepting once, when oil had been given. The temperature was normal; pulse about 80; the abdomen greatly distended, slightly more so on the right side than on the left. The patient complained of some pain on the left side which came on in paroxysms. Nothing could be felt by the rectum or by the vagina. Her general condition was very good, but it was evident that she was suffering from complete obstruction of the bowels, which in a short time would end fatally unless some radical relief was offered promptly. I thought that she was suffering from a volvulus or else from a growth in the cæcal region. A notable point in view of the findings at the operation is the fact that there was no history of ribbon stools or the passage of bloody mucus. Considerable time was lost in convincing the patient of the necessity for an operation, and especially of the necessity for her removal to a hospital. This was finally accomplished, and at about three o'clock I operated. As the right side of the abdomen was more distended than the left, I determined to open through the right rectus. The moment the peritoneum was divided there escaped a quantity of peculiar gelatinous material, light in color, resembling the contents of a colloid cyst. There also presented in the wound an enormously distended cæcum, dark in color, which looked like a cyst. I supposed that there had been a rupture of a malignant ovarian cyst. When the wound was enlarged, however, the cæcum was delivered. It was distended more than I had ever seen it. The appendix was also very much thickened but not distended, and attached to it was a quantity of the same gelatinous material which had escaped from the abdomen. The cæcum was so distended that I realized that I would be able to do nothing inside the abdomen until its size was reduced. When delivered, a quantity of its contents rushed into the small intestine, rapidly distending this portion of the bowel which had before been practically empty. I thought that in some way the opening from the ileum into the cæcum had been obstructed. The cæcum was punctured with a knife; a large quantity of gas rapidly escaped and the bowel collapsed. The opening was then closed and I made an exploration of the abdominal cavity. There was no mass in the pelvis, the uterus being very small and the ovaries atrophied. I noticed one or two small nodules over the broad ligament, however. Examining the colon I found a mass about the middle of the descending colon. This could not be delivered through the wound on the right side and I therefore opened the abdomen through the left semilunaris. Before I did this, however, I was obliged to reopen the cæcum because it could not be returned to the abdomen, as it had again become distended with gas. Through the opening on the left side I delivered the mass in the colon which seemed to be a carcinomatous growth producing an annular contraction of the bowel. With some difficulty, because of the shortness of the mesocolon, I succeeded in resecting about ten or twelve inches of this bowel, going about 8 inches above the growth and about 3 inches below it. An end-to-end anastomosis was made by means of a large Murphy button. A gauze drain was introduced down to the site of anastomosis and the wound closed. Before closing the wound on the right side I removed the appendix; and it presented the appearance already described which I had never seen before. The patient was on the operating table one hour and forty minutes. Her pulse at the end of the operation was 100 and her condition remarkably good. I was prepared for considerable shock but was surprised later to find the patient in excellent condition and remarkably free from pain.

January 9, 1905: Since the operation the patient's progress has been surprisingly satisfactory. Last night her temperature rose to about 102, but this morning it is 99 and her pulse about 110. She has been taking a moderate amount of liquid nourishment and salt solution enemata. Yesterday and last night she passed a large amount of flatus and is much more comfortable. The distention of the abdomen is greater this morning than it has been since the operation, but there is less pain and the patient is much more comfortable. She has received small doses of calomel to relieve her distention, and this morning in addition to this she was given strychnia. .

January 10: Last evening the distention had increased considerably, the patient was very uncomfortable from it,—had some difficulty in breathing and was belching a good deal. I therefore decided to open the wound on the right side and tap the cæcum. This I did without any difficulty at all, administering the patient a small amount of ethyl chloride. The colon was exposed for an area of one and one-half inches, and a small trocar introduced. A quantity of gas escaped through the cannula, which was left in position, and the patient was rendered more comfortable at once. Since doing this, there has been a marked improvement in her condition; she has had two bowel movements and her temperature and pulse are both lower. It looks now as if she would certainly recover.

January 16: Continues to improve, temperature remains about normal. On the sixth day after the operation there was a marked odor to the dressing on the left side, and when I removed the gauze packing there was an escape of gas and some liquid fæces. For twenty-four hours previous to this the patient had been unable to void the urine, and had to be catheterized. Since the change of dressing she has voided her urine. The discharge from the left wound has been quite free, and contains some fecal matter. There has been less fecal matter passed per rectum, and also less flatus. The right wound looks well; it is packed with iodoform gauze down to the exposed bowel, from which there is no leakage. To-day the patient is taking semisolid food and looks much better. The button has not passed.

January 30: Two days ago, when dressing the left wound, I extracted two large pieces of mucus which looked like sponges. These were evidently sloughs from the colon somewhere and I suspect from the cæcum. After their passage there was some leakage from the small puncture of the cæcum of the right wound. Yesterday I introduced a glass catheter into this opening and passed quantities of salt solution through the colon, washing out a quantity of fæces but no more sloughs. I then injected some salt solution and whiskey which was followed later by malted milk. This was done because the patient declined to take sufficient food. She gradually grew much weaker and has been comatose at times. To-day she grew still weaker, and died about 2 P.M.

A post-mortem examination was made by Dr. Longcope, who found that the colon had sloughed at the point of anastomosis and that the button had dropped into a pocket behind the colon.

Comments: A primary resection should not have been done in this case nor should a Murphy button have been used. A lateral anastomosis would have been better than an end-to-end one.

CASE III.—G. D.; female; 68 years of age; Pennsylvania Hospital. Diagnosis: *Partial obstruction and carcinoma of transverse colon and sigmoid. Resection of transverse and descending colon; immediate anastomosis,* March 5, 1905. *Recovery;* well to-day.

I saw this patient in consultation with Dr. David Edsall. The history of active trouble in this case extends over but three weeks. Previous to that time, however, the patient had had considerable trouble with her digestion and, at times, difficulty in having her bowels move. She had also had attacks of acute pain, evidently peristaltic in character. Three weeks ago she was suddenly seized with severe abdominal pain, and her bowels were opened with some difficulty. There was little distention at any time, but there was a great deal of abdominal pain and marked peristalsis. The peristalsis was visible through the abdominal wall. Examination a few days later revealed a mass in the left iliac fossa which was movable and tender; it varied much in size, and sometimes a little kneading would cause it almost entirely to disappear. There was never at any time a discharge of blood or mucus. When, with Dr. Edsall, I saw her we discussed but two possibilities: one, malignant disease of the sigmoid, and the other a chronic intussusception. My inclination was toward the first of these, as the mass seemed hard and there had been no discharge of blood or mucus as would have occurred with an intussusception. The patient was removed to the Pennsylvania Hospital.

I opened the abdomen through the outer border of the left rectus, opposite the spine of the ilium. As soon as the peritoneum was divided there presented in the wound what I supposed to be a dilated colon, but which proved to be the stomach. After some difficulty I was able to differentiate the various structures and discovered we were dealing with a large malignant mass about the middle of the transverse colon which had gravitated to the left iliac fossa, dragging the stomach with it. Here the mass had become adherent to the sigmoid, the wall of which was involved in the cancer mass, but the sigmoid was not obstructed. The distal portions of the transverse and the descending colon were perfectly flat—contracted, in fact, to about the size of the small intestine. Proximally to the growth there was not much distention. My first idea was to do a double resection, first of the transverse colon and then of the sigmoid. The entire mass was surrounded by omentum. I tied off the omentum close to the greater curvature of the stomach and included in the ligatures the mesocolon, in order to shut off the lesser peritoneal cavity. When I had done this I found that if I resected a proper amount of bowel at the two situations there would be left only about five or six inches of descending colon, and rather than leave this and make two anastomoses I concluded to remove the entire transverse and descending colon with the involved portion of the sigmoid and attach the hepatic flexure of the colon to the distal portion of the sigmoid by the end-to-end method. This I did without any difficulty after the method of Moynihan, using the Doyen forceps. The anastomosis was the most satisfactory one I have ever made; there did not seem to be the slightest possibility of any leakage. Therefore I did not insert a drain, but closed the abdomen in layers. The operation took one and one-quarter hours. The patient was anæsthetized with ethyl chloride and ether. The glands in the mesocolon and mesosigmoid were not much larger than normal. The patient reacted well from the operation. At the beginning of the operation her pulse was 120; at the conclusion it was 90.

March 6, 1905: Her temperature since the operation has not reached 100 and her pulse at one time was 108. This morning it was 88. She has passed urine frequently but without difficulty and also expelled some flatus through the nozzle of a syringe. She has been very troublesome and nervous, but so far as her general condition is concerned she is in excellent shape and, I think, should make a good recovery.

March 13: Since operation the patient has done remarkably well; the bowels have moved freely and, excepting a marked melancholic tendency, there has been nothing to worry about. For the last day or two she has complained of frequent micturition. To-day I dressed the wound and found the skin lifted up by an accumulation of very odoriferous pus. Quite a little gas escaped when the wound was opened. The skin had healed perfectly; all the stitches were removed. This infection had taken place without disturbing her general condition and without giving her any amount of pain. I believe that the infection is only a superficial one and do not think it is connected in any way with the seat of anastomosis.

March 22: Since the last note there has been more or less fecal discharge every day through the wound; at times it has been quite profuse. Lately there has been a slight rise in temperature at night, but otherwise the general condition seems to be good. Inability to control the urine at times is very distressing to the patient. For three days she has been sitting up in a wheel chair for an hour or more.

March 29: There has been no fecal discharge from the wound for three or four days and her condition is greatly improved, the bowels moving regularly without aid. She is eating much better. She spends four or five hours out of bed every day.

April 2: The wound is healing rapidly, but she developed last night a phlebitis of the left leg.

April 3: The pain in the leg is less but the swelling remains about the same, and there is a slight increase in the pulse rate with no fever.

May 10: She has been doing very well until about two weeks ago, when the sinus was so nearly healed that I thought that I might leave out the gauze packing, which I did for two days. When I came to dress it at the end of this time an accumulation of pus had taken place and some burrowing under the skin externally. Since then there has been more pus and a small amount of fecal matter discharged. To-day I determined in view of the fact that there had been a slight rise in temperature in the evening, that there must be some fault in the drainage, and gave her ethyl chloride, opened up the wound thoroughly, curetted out two pockets and packed it with gauze.

May 22: Wound has been rapidly contracting and her general health has been much better. She is able to go about and is going home to-morrow.

May 1, 1909: Patient's wound has remained healed and she is well to-day; no evidence of recurrence.

Comments: Probably a lateral anastomosis here would have given a better result, or perhaps a drain might have shortened the convalescent period.

Pathological diagnosis: Polypoid adenocarcinoma and tuberculosis of colon.

Case IV.—J. S.; male; 40 years of age; Pennsylvania Hospital. *Tuberculous strictures of ileum; tuberculous peritonitis. Resection of ileum and cæcum,* September 28, 1905. *Second operation,* January 20, 1906, *for fecal fistula. Lateral anastomosis of ileum and transverse colon. Third operation,* January 11, 1907, *same condition; lateral anastomosis of ileum and sigmoid. Fourth operation,* May 1, 1907; *resection of transverse colon with a portion of the ileum. Fifth operation,* May 19, 1907; *jejunostomy. Died* May 21, 1907, *twenty months after his first operation.*

This patient, a negro, had been in the hospital ten days or two weeks. His symptoms were so obscure that it was impossible to make a diagnosis. He complained of general pain in the lower half of the abdomen, with considerable disturbance of digestion. He said he had vomited, but he vomited only once or twice after his admission. A test meal was given but nothing abnormal was found in the examination. His abdomen was always scaphoid and somewhat rigid. On the right side in the iliac region, on two occasions I thought I felt a distinct movable mass which was probably an enlarged gland. There was no fever at any time and no blood or mucus in the bowel movements. A rectal examination showed some tenderness behind the bladder. After keeping him under observation for a number of days I concluded that he had probably a tuberculous peritonitis, and that an operation was justifiable. When the abdomen was opened through the right rectus the first thing which the hand encountered was the ileum very much contracted at two points, one near the cæcum and the other a number of inches away from it. These areas of contraction were probably one and one-half to two inches in length and the whole thickness of the bowel was involved, the peritoneal coat being studded with small tubercles. The mesocolic glands were enormous; the mesenteric glands on either side of the diseased ones seemed perfectly normal. There was not an excessive amount of fluid in the peritoneal cavity. There was no evidence of tuberculosis elsewhere. I determined to excise the entire diseased area together with the cæcum and the enlarged glands. In order to get out all the glands and the mesentery which contained them, I found it necessary to divide the ileum at least 12 to 18 inches away from the proximal side of disease. The colon was divided at the middle of its ascending portion and its end inverted by two rows of sutures—one of catgut and one of celluloid thread. The same was done with the end of the ileum, and then a lateral anastomosis of the ileum and transverse colon was made with the Doyen forceps. The operation was perfectly clean and there was no possible soiling. It occupied a very long time, two hours and ten minutes. This was partly due to the fact that after making one division of the ileum and inverting the ends, I found it necessary to go higher up on the bowel because of the enlarged glands in the mesentery. On examining the specimen after removal it was found that the distended portion between the two strictures contained several ounces of watermelon seeds. He said that he had not eaten watermelons for nearly a year, but considering the season and the tendencies of his race this is to be doubted.

September 30, 1905: He has done very well since the operation and shows no bad symptoms at all.

October 2: He had considerable pain in the abdomen last night and vomited. To-day his abdomen is rigid and there is some soiling of the gauze drain which was introduced. Ethyl chloride was administered and the drain withdrawn. There escaped a quantity of gas and considerable liquid fecal matter. This leak, I think, comes from the inverted ends of the bowel as the gauze drain extended down to this point and not to the point of anastomosis. Notwithstanding this leak he is now comfortable and the bowels have moved. A fresh gauze drain was introduced. The patient was discharged December 19 with a small sinus.

January 20, 1906: The patient has improved a great deal since his first operation but has continued to suffer from a slight fecal fistula. The discharge from this fistula is almost liquid, but at times—the patient says—fecal matter comes out. He complains also of painful peristalsis, and I had an opportunity to observe this in a distended coil of bowel extending from the left iliac fossa up in the direction of the wound. Thinking that possibly the fistula led to the blind pouch of colon left at the previous operation, I determined to make the incision on the outer side of the old scar, and this I did. Before being able to make out the situation, however, I was obliged to separate the fistulous opening in the wall from the bowel and do considerable separation of adhesions. Finally I discovered that the fistula opened into the bowel probably at the point of anastomosis. The proximal portion of the ileum was enormously distended and hypertrophied. This extended up for about two or three feet. The colon was quite collapsed. As the intestines were so matted together in the right upper quadrant I determined to make a new anastomosis between the ileum and the transverse colon, and this I did after the manner of Moynihan. The fistulous opening into the bowel I closed with two catgut sutures and introduced a drain down to this point. The new anastomosis was surrounded by omentum and the abdomen closed, excepting at the point of drainage.

January 22: Patient is more comfortable to-day and has done remarkably well since his operation.

March 1: Patient was discharged from the hospital to-day, the sinus still persisting but no fecal discharge.

January 11, 1907: Since his last operation he has been free of pain and has gained considerably in weight. The fecal fistula redeveloped, however, and has continued open ever since. In March, Dr. Le Conte operated and tried to close the fistula, but unsuccessfully. There is no longer any painful or visible peristalsis, but large quantities of fecal matter escape through the fistula. I determined that the best thing to do was to open the abdomen on the left side, divide the ileum near the old point of anastomosis and attach the proximal end by lateral anastomosis to the sigmoid. I opened the abdomen through the sheath of the left rectus and found the abdominal cavity in good condition excepting for numerous small tubercles over the bowel and mesentery. There was no fluid and no enlarged glands. The last anastomosis was in good condition and working. There was no hypertrophy or distention of the bowel. At the second operation I did not divide the ileum but simply made a lateral anastomosis. To-day I cut the ileum near the old anastomosis, inverted the two ends and attached the proximal portion to the upper portion of the sigmoid by a lateral anastomosis. The steps of the operation were easily performed and the result apparently was very satisfactory. The abdomen was closed without drainage. I did not do anything to the fistulæ on the right, hoping that they would close.

February 4: Since this operation the patient has progressed very satisfactorily. At first there was free discharge of fecal matter from the old fistula, but this stopped after a few days. The fistula was Y-shaped, having two external openings, one of which closed very promptly after operation, but the other is still discharging a small amount of mucus and pus. The patient's temperature is normal and he is able to move about and is quite comfortable.

The specimen removed at the original operation was exhibited at the meeting of the Philadelphia Academy of Surgery held on February 4, 1907. "It is 38 cm. long, 34 cm. of ileum and 4 cm. of cæcum. The mesentery is attached to the intestine and contains a number of enlarged glands. There are two constrictions, one 5 cm. from the ileocæcal juncture, and the other 13 cm. above this one. The bowel between the two constrictions is very much distended and thickened; in this distended portion between the two constrictions there were found, when the specimen was examined, two or three ounces of watermelon seeds with one grape seed. The peritoneal covering of the bowel and mesentery was studded with small tubercles, and numerous hard bodies can be felt in the intestinal wall. The mesentery is very thick and contains a number of large glands, the largest measuring 4 x 3½ x 2 cm. These glands on section proved to be caseous. The appendix is tightly bound down to the cæcum by adhesions. The lower stricture is 3 cm. in length and the lumen of the bowel at this point ½ cm. The second stricture is 1 cm. in length and the lumen 1½ cm." The pathological diagnosis was tuberculosis of the intestine with chronic ulceration; tuberculosis of the mesenteric glands, and hypertrophy of the muscular wall of the intestine.

May 1, 1907: Since the last operation the patient's general health has been very good, but there has continued to discharge from the sinus a quantity of pus and mucus. He says fecal material at times also passed out, but I have had his dressings carefully watched for several consecutive days at the hospital, bringing him in for this purpose, but have found no fecal matter. He is very much disturbed by the discharge and the necessity of constant change of dressings, so I determined to open the abdomen again and remove all of the bowel that had been side-tracked by the last operation. To-day I opened the abdomen through the right rectus and excised the colon from the splenic flexure back to the point of original excision. Together with this bowel there were removed two feet of ileum. At the point of division of the colon the bowel was perfectly healthy, and I had no difficulty in turning it in. The whole intestine was one mass of adhesions and I had considerable difficulty in isolating the portion which I wished to remove. A thorough twisting and malposition of the small intestine made the operation long and difficult. The only portion of the bowel removed which was really distended was the ascending colon, and that was filled with tuberculous ulcers of the mucous membrane. The peritoneum generally was in much better condition than at the previous operation, and at several points on the small intestine there were cicatrices of healed tuberculous lesions. When I removed the bowel I felt that I had taken out all the diseased tissue except a few mesenteric glands, and hoped that the patient would be entirely relieved. The abdomen was closed without drainage excepting for a small piece of gauze extending just through the abdominal wall at the seat of the old fistula. The operation lasted about two hours.

May 3: Patient's temperature has remained normal since operation; he has had no vomiting, no distention, and his general condition has been very good.

May 21: The patient did very well for several days after his last operation. Then he began to have fecal discharge that I judged came from the loop of small intestine that had been adherent to the old abscess and which I had tried to cover with peritoneum. Discharge has increased during the last few days and the patient has emaciated a great deal. I tried rectal feeding, but this did not help matters. To-day I decided to do a jejunostomy or resection of the perforated bowel. The patient was in very poor shape. He was put on the operating table and four pints of normal salt solution put into his circulation. Under morphia, ethyl chloride and ether anæsthesia the wound was opened up, the loop of bowel delivered, and the perforation found. It was too large to close, and after thoroughly cleansing the cavity the bowel was fastened in the wound with gauze packing and a tube passed down into the distal portion of the loop and fixed with a purse-string suture. The patient was immediately given a pint of salt solution and two ounces of whiskey through the tube.

May 20: Patient is in pretty bad shape, although he was much better last night than before his operation. He has been given raw eggs and peptonized milk through the tube every three hours and has vomited small amounts at times to-day. His temperature is subnormal and he seems in pretty bad condition.

May 21: Patient died to-day. At the postmortem his entire intestinal tract measured but 19 feet.

CASE V.—S. B.; female; 57 years of age; Pennsylvania Hospital. Diagnosis: *Obstruction of bowels due to carcinoma of sigmoid. Operation: Colostomy, and eight days later resection and anastomosis. Recovery, with death from recurrence one year later.*

This patient was a rather thin person who gave a history of ribbon stools for some time with marked constipation. She stated that she had never passed blood excepting after the use of an enema and then only a slight amount. Had never had any previous attack of obstruction. She was a Christian Scientist, and her treatment was confined to this art until about a week ago when constipation became much more marked; she then took castor oil. For forty-eight hours she passed neither fecal matter nor gas, her abdomen becoming more and more distended, and she has vomited everything that has gone into her stomach. When I saw her at about 10 P.M., her condition was good,—the abdomen was markedly distended, coils of bowel and peristalsis being plainly visible through the abdominal wall. Dr. Lee had examined the rectum and could feel nothing abnormal. The sigmoid could be felt, and was markedly distended. Most of the pain and tenderness was located about the cæcum. I urged immediate operation, with the intention of establishing an artificial anus and later removing the cause of obstruction if it were removable. The abdomen was opened through the left rectus and a growth about the middle of the sigmoid readily found. There were a number of enlarged glands in the mesosigmoid.

The growth was of the contracting variety and had completely shut off the bowel. I had no difficulty in delivering the intestine, and then made an anastomosis between the bowel above and below the growth by means of a Murphy button. I left this knuckle of bowel completely outside the wound. In a few days, the patient being in better condition, I intended to resect all the involved intestine. I was greatly tempted to do this at the time of operation because the patient seemed in good condition, but because of past experience and the experience of others deemed it unwise.

September 10: Although patient has passed some flatus there has been no bowel movement. Some distention still exists and patient is very uncomfortable. To-day I opened the distal portion of the bowel; a prompt escape of a large amount of gas and fecal matter followed.

September 16: Two days ago, eight days after first operation, I resected the involved sigmoid. Patient had improved a great deal and seemed in good condition. I found that the wound had become infected from fecal discharge and had therefore to exercise great care to prevent infection of the peritoneum. The area was well walled off and I was able to draw the bowel out very satisfactorily. I made a wide resection of the involved portion, invaginated the two ends and did a lateral anastomosis, using linen thread. The operation was easily accomplished and satisfactory in every way. A small drain was put through the peritoneum in the middle of the wound and another down to the peritoneum at the upper angle where the infection had occurred. The patient stood the operation well and is now in good condition; her only complaint is of gas. She made a very satisfactory convalescence and was discharged October 12, 1907.

January 21, 1908: Patient came in to-day; seems perfectly well: weighs 104 pounds. Thinks she weighed 80 when she went to the hospital; weighed 79 pounds when she left. Bowels move regularly without a laxative.

June 2: Patient complains of considerable lassitude and says she has some abdominal pain. Bowels are moving, however, and I can feel no evidence of any recurrence. She thinks she has lost weight, but her weight is exactly what it was on her last visit.

July 22: Patient has been seen by a physician who told her she had a recurrence of her trouble and that all he could do for her was to make her comfortable. This has depressed her very much and tended rather to aggravate her symptoms. She says that she sleeps badly, her appetite is poor, and that she has almost constant pain in the left iliac fossa. The bowels, however, move regularly from cascara, and there has been no blood or mucus in the movements. Weight, 92½ pounds. On examination there is some hardness to be felt to the left of the wound, but it feels as if it might be in the abdominal wall. I am by no means sure she has a recurrence but have advised X-ray treatment, for which she will go to Dr. Manges.

Patient, a few weeks after this note was made, died from recurrence, but had no obstruction.

Case VI.—M. W.; female; 58 years of age; Jefferson Hospital. Diagnosis: *Carcinoma of appendix and cæcum. Resection of cæcum, lateral anastomosis, October* 5, 1907. *Death on seventh day after operation.*

This patient was referred to me by Dr. Robert L. Gibbon, Charlotte, N. C. She had always been healthy, and had given birth to eight children. In February, 1906, she had an attack which was diagnosed as appendicitis. Was ill a week; the symptoms disappeared under rest and ice. Six weeks later she had a second attack which lasted but a few days. A marked symptom in these attacks was severe localized pain and slight temperature. No nausea or vomiting and no urinary symptoms in either of these attacks. She remained well until six weeks ago, when she had another attack similar to the first but more marked. There was considerable fever and, excepting for the nausea, the symptoms were typical of an acute appendicitis. In this last attack a mass could be felt in the cæcal region. She gradually improved and was quite comfortable when I saw her. Examination of the abdomen was negative excepting for a tender and slightly movable mass in the right iliac fossa. In view of the history and the absence of other symptoms it seemed likely that this was a case of appendicitis with a walled-off abscess. I advised operation, and two days later, October 5, I operated at the Jefferson Hospital.

The abdomen was opened through the right rectus and a hard mass encountered behind the cæcum. There were no omental adhesions. General abdominal and pelvic cavities were walled off and a line of cleavage sought between the mass and the neighboring viscera. The mass was so dense that I feared I was dealing with a malignant growth. Finally I got the cæcum separated. When brought to the surface I found that the appendix had separated at its attachment and that there was quite a large opening in the cæcum. Where the appendix was detached there was evidently a malignant growth, and on examining the interior of the cæcum I found that this growth extended across the lower end of the bowel and up as far as the opening of the ileum. I then proceeded with a resection of the cæcum, going 6 or 8 inches above the growth and making a lateral anastomosis between the ascending colon and the ileum, using linen thread for the purpose. When I had completed the anastomosis I proceeded to get out what remained of the appendix; this was a difficult undertaking, as it was tightly bound down. The distal portion of the appendix, however, did not seem to be so much diseased as the proximal portion. It was impossible to ligate the mesoappendix as I simply had to dig the appendix out of its bed behind the cæcum. A gauze drain was put in and the wound partially closed.

October 8: Patient has done only fairly well since operation. Yesterday morning she seemed in good condition; but in the afternoon she suffered a great deal from nausea but vomited only once or twice, and then only small quantities. She voids urine voluntarily; her temperature range is between 99.2° and 101°. She has taken very little nourishment and drinks water in small quantities. The bowels have not moved though she passed some flatus to-day when an enema was given. There is no distention of the abdomen; the tongue is moist. Nausea and backache are the only complaints which she makes. Pulse has been somewhat rapid, ranging from 110 to 130.

October 9: Patient is better, though still has occasional nausea. She has complained of distention, but this is not perceptible, and has passed large quantities of gas by the bowel. Last night she had a slight movement following an enema. She has taken little in the way of nourishment excepting peptonoids, but she has had nutrient enemata. She passes a good quantity of urine. Her temperature varies from 99.2° to 101°.

October 11: Patient's bowels have moved very satisfactorily and a number of times. There is no vomiting but the nausea continues, although she is able to take a certain amount of liquid nourishment and stimulation. Her temperature continues around 100° and 101°. Her pulse remains between 110 and 120. There has been a decided falling off in the urine and to-day she has passed little or none.

October 12: Her condition yesterday grew much worse. She was in a stuporous condition all day, secreted very little urine and declined to take nourishment. The bowels moved five or six times. I changed the drain the day before, and although it was soiled and had a bad odor there was no escape of fecal matter or pus on its withdrawal. Her condition continued to grow rapidly worse and she died at 4 o'clock this morning. It is hard to know exactly what caused this death. There is no doubt that the anastomosis was working perfectly satisfactorily. There was no distention and no vomiting, so I felt if there was a peritonitis it must have been a low grade of infection. There was some kidney secretion in the last twelve hours, but I think that the kidneys were largely the cause of the death.

Pathological diagnosis: Cylindric-celled carcinoma arising from an adenoma.

Case VII.—G. N.; male; 33 years of age; Jefferson Hospital. Diagnosis: *Carcinoma of ascending colon,* March 28, 1908. *Recovery; well at the present time.*

This patient gave a history extending over 6 or 8 months. During this time he has had considerable soreness and tenderness in the right upper quadrant of the abdomen, in which a tumor has developed. He has had very black, tarry stools. Has never vomited, and pain is uninfluenced by eating. He has no pain referred to the shoulder or back. There is no apparent distention of the stomach. Examination shows a marked rigidity below the costal border and the sensation is conveyed to the hand as of a tumor beneath the upper half of the right rectus; it is exactly in the position of the gall-bladder. There is no history of colic, and I was inclined to believe that he had a duodenal ulcer with a mass of adhesions about it. Others thought that the tumor was probably a gall-bladder. His hæmoglobin was 65 per cent., but he had a good proportion of red blood cells. His bowel movements were very black, but it is reported that no blood was found. I opened the abdomen through the right rectus and found a large growth in the hepatic flexure of the colon, covered by adherent omentum. There was no extension to the gall-bladder or liver, but there was an extensive involvement of the colic lymph-nodes. The patient was in no condition to stand an extensive operation; his pulse became quite weak on the table. I determined that it was worth while to attempt an excision of the growth, but thought it wiser to do the operation in two stages. I therefore divided the ileum near the ileocolic juncture, closed both ends and then made a lateral anastomosis (Moynihan's method) between the proximal portion of the ileum and the transverse colon. I put in a small drain down to the closed distal end of the ileum.

April 1: Patient is in good condition. Drain was changed to-day. I think in two or three days I will be able to complete the operation.

April 11: Patient has improved very much since the first operation, and seems in good condition to stand the second. The abdomen was opened through the same incision in which the drainage had been going on, and in which there was a slight infection. I had no difficulty in bringing up the cæcum and ligating its mesentery. I then divided the transverse colon and inverted it. In bringing the mass out of the abdomen, I was surprised to find a coil of small intestine adherent on its inner posterior aspect. On careful examination this proved to be the duodenum. At first it looked as if a resection of this portion of the bowel would also be necessary, but I found when I separated it that practically only its peritoneal coat was involved in the mass. Several sutures were put in to repair the loss of the peritoneum. There was no involvement of the liver or gall-bladder in the growth. The kidney was thoroughly exposed, but there was no extension of the disease to it. A posterior drain was carried out through a puncture in the loin. A small drain was then carried down to the inverted colon and another placed in the superficial wound at its lower extremity. Patient stood his operation well, considering the great extent of it.

April 15: Patient's condition is very satisfactory. Two days ago I was worried because he had considerable cough, which is probably due to the fact that he is a miner and has a miner's lung. His bowels have moved well.

April 24: Patient is making a very satisfactory recovery, although there has been considerable discharge of the wound, which was infected at the time of the second operation. Patient is sitting up and his bowels are moving normally.

May 17: Microscopical diagnosis: cylindric-cell epithelioma. Wound entirely healed. Patient gone home.

February 12, 1909: Letter from Dr. G. A. Cunningham, the patient's physician: "He has gained thirty pounds, has no indigestion, flatulence never occurred; he is now engaged at the laborious task of coal mining, but has had no complaint of any kind regarding weakness of the abdominal wall. He has had no medical assistance whatever since the operation. His bowels are regular."

Case VIII.—M. A.; female; 71 years of age; Bryn Mawr Hospital. Diagnosis: *Acute intestinal obstruction due to carcinoma of splenic flexure. Colostomy,* May 12, 1908, *followed by resection* May 20, 1908. *Death* June 6, 1908.

This patient has had more or less trouble with her bowels for about a month, and during the last four or five days has had difficulty in having a movement. When I saw her just before operation her abdomen was distended; there was no evidence of fluid and she was vomiting. Her temperature and pulse were normal and she seemed in good condition. I thought it wise to operate at once, and as I believed the obstruction to be in the upper rectum, I made an incision through the outer portion of the lower left rectus. The small intestine was considerably distended and filled the pelvis. The rectum, sigmoid and descending colon were collapsed. The transverse colon was distended. Passing my hand up to the splenic flexure I found a small hard mass in the bowel. Instead of making a lateral anastomosis between the transverse colon and the sigmoid, which I could easily have done, I made another small opening in the upper portion of the rectus, hoping that I might be able to deliver the growth through it; I found, however, that it was situated just at the splenic flexure and that only with great tension could it be brought within the wound. It was about the size of a hulled walnut and was shaped like a Murphy button, and apparently completely obstructed the bowel. I then made an opening in the transverse colon after fixing it in the wound. I used Stewart's method for draining the bowel.

May 20: Patient has made a very good recovery from first operation, and to-day I undertook the removal of the growth. I first closed the colostomy opening, increased the wound, tied off the gastrocolic omentum, divided the colon proximal to the colostomy wound, and then proceeded to remove about 8 inches of the transverse colon together with the splenic flexure in which a small hard growth was present. I also removed about 4 inches of the descending colon. I had considerable difficulty in separating the growth from the spleen, and in doing so tore off a small portion of the spleen, which caused a rather profuse hemorrhage, which was controlled by a pack. The mesocolon was so short that it was difficult to get the ligatures behind the growth. I finally managed to get the growth out fairly satisfactorily. There was present a small hard nodule in the kidney, but I could not make out that it had any connection with the growth in the colon. The ends of the divided colon were inverted and a lateral anastomosis made. Catgut sutures were used for the deeper suture and linen thread for the outer. The operation was an extremely difficult one and required about an hour and fifty minutes for its performance. I think it would have been easier if I had made a lateral anastomosis and short-circuited the growth at my first operation instead of doing a colostomy. The removal of the splenic flexure would have been just as difficult, however, but the operation would have taken less time. The patient stood the operation fairly well.

May 25: For several days after operation she had a great deal of nausea and vomiting. Gastric lavage relieved the vomiting. During the past two days she has had a bad attack of diarrhœa; during the last 24 hours but 15 stools, but in the previous 24 hours 28 stools. These occurred without the administration of any laxative whatever. Irrigation of the rectum relieved her a great deal and she is much better to-day. There is a good deal of odor about the wound and the drain has not yet been changed. Her temperature range is between normal and 100°. Her pulse, which was quite rapid on the day after operation, reaching about 160, has recently remained in the neighborhood of 100.

May 26: To-day I removed the packing. There was no bleeding; the wound is very foul and there is some sloughing along the muscle edges. She is still very weak but the diarrhœa is much better. The great difficulty is to get her to take sufficient food. She has been gotten up into a chair and put out in the yard, which I hope will help her.

May 28: Fecal fistula has developed—but free stools by rectum.

June 6: Patient died to-day after gradually growing weaker. Temperature has not been above 100° for a week and lately has remained a little below normal. Death probably resulted from a low-grade infection. No post-mortem examination was made. Through an error in technic the sections of this tumor were spoiled and the rest of the growth lost. There can be no doubt of the clinical diagnosis, as it resembled in every way the growths found in Cases I, II, V, and X.

CASE IX.—S. B.; female; 27 years of age; Pennsylvania Hospital. Diagnosis: *Tuberculosis of cæcum and peritoneum. Resection of cæcum. Recovery;* well to-day.

This negro girl was admitted to the ward because of what was supposed to be a pus tube on her right side. She stated that she had had trouble with menstruation and considerable abdominal pain for some time, and that the week or two before she came into the hospital she had a great deal of pain and, she thought, some fever. On admission her temperature was 99½°. There was a distinct mass in the right iliac region; there was great tenderness on vaginal examination, especially on the right side; the mass was very hard for a pus tube and I thought it likely that she had an appendicitis as well as a pus tube. She had no general abdominal pain. I opened the abdomen through the right rectus near the median line and found the omentum adherent over the cæcum. Exploration of the pelvis showed numerous adhesions between the uterus and the intestine and all around the tubes and the ovaries. These were recent and were easily broken up. The rest of the cavity was well walled off with gauze from the mass in the iliac region, and then I discovered that the mass was not the appendix but was composed of a thickened cæcal wall and adherent omentum. Close investigation showed thickening and a mass in the cæcal wall with extensive infiltration, making the cæcum quite friable. The omentum was then tied off. The mass was about the size of a silver dollar and involved the anterior wall of the cæcum. There were numerous enlarged glands in the mesentery of the ileum and cæcum and numerous tubercles over the small intestine. There was quite a ring of thickening around the ileum about a foot from the cæcum, but no constriction. I determined to resect the cæcum. I then discovered another mass higher up in the cæcum, and in order to get beyond the disease was obliged to remove the colon as far up as the hepatic flexure. The ileum was divided near the cæcum and the ends inverted with catgut and linen thread. A lateral anastomosis was then made between the middle of the transverse colon and the ileum. The transverse colon was also covered with adhesions, the omentum being adherent to it, and it was quite difficult to find a clear spot for the anastomosis. The divided mesentery of the ileum was sutured to the mesocolon to prevent any possibility of a hernia through this opening. Two small gauze drains were passed, one to the site of anastomosis, the other to the inverted colon, and the wound closed. The appendix was imbedded between the cæcum and omentum but apparently was not the original seat of the trouble.

Except for some superficial infection of the wound and two alveolar abscesses the patient made a good recovery. The wound healed by granulation, but there was no leak. Discharged February 24, 1909. The patient's present condition is normal. The pathologist expected to find tubercle bacilli because of the appearance of the specimen, but was unable to do so on repeated examination. The gross picture was typical of tuberculosis.

CASE X.—M. H.; female; 57 years of age; Mercer Hospital, Trenton, N. J. Diagnosis: *Carcinoma of sigmoid. Resection and immediate anastomosis,* January 31, 1909. *Death,* February 14, 1909.

I saw this patient in consultation with Dr. Holcombe and Dr. Ridgeway. She has one child who is 20 years of age. The mother has always been very well until seven years ago, when the left breast was removed for what appeared to be cancer. No microscopic examination of the growth was made. For some months she has been troubled with constipation, but has passed neither blood nor mucus. She has also lost some weight in the last few months. It is said that she had a tumor in the right breast; the tumor has disappeared. From the history given of this growth, I think that it was probably a cyst. Three weeks ago she began vomiting and her abdomen became markedly distended; since when she has been able to retain practically no food and has had no satisfactory bowel movement. Numerous enemata have been given and small particles of fecal matter have at times been returned. She was a thin, anæmic woman, looking older than her age, but in fairly good condition. The abdomen was markedly distended and the vomiting was more or less persistent, but not of a fecal type. Palpation showed some rigidity in the region of the sigmoid, but more in the upper right quadrant. The ascending colon seemed to be distended, and as there was much tenderness over the sigmoid, I concluded the obstruction was probably at this point.

Following a hypodermic of morphia and atropin, she was given ethyl chloride and ether, and the abdomen opened through the left rectus. I found the descending colon very much distended, and on withdrawing the sigmoid came at once upon the cause of the obstruction, which was a growth involving the interior of the bowel and producing so marked a constriction as to practically completely obstruct it. Only one gland could be felt in the mesentery. About 6 inches of bowel was excised, including the growth, and a lateral anastomosis done. The ends of the bowel were inverted with catgut and silk and the anastomosis made with catgut and silk; as the operation was accomplished outside of the abdomen and the wound well protected with gauze, no drainage was inserted. While the abdominal wound was being closed a rectal tube was inserted into the rectum and a quantity of gas and liquid fæces escaped and the abdominal distention at the same time disappeared.

February 8: The patient's wound is healed and there is no pain or abdominal tenderness. The abdomen has been perfectly flat ever since her operation. During the last few days she has been vomiting and has had a very troublesome diarrhœa, I am told. The night before last she vomited practically everything that was taken. I talked with Dr. Holcombe over the 'phone and advised that her stomach be washed out. To-day I got a very good report from her. There has been no vomiting since yesterday morning, the bowels have moved but once, and she has been able to retain liquid food.

February 14: I had supposed that this patient was doing very well until last evening, when I received a telephone message saying she was in a bad condition and that a mass had developed in the left loin. I felt sure that there had been a leak at the site of anastomosis, and advised that the wound be laid open freely, and arranged to see the patient to-day. When I arrived I found her in an extremely low condition. On removing the dressings I found them soaked with a quantity of dark liquid fecal matter.

The wound had opened throughout its length and there were great masses of necrotic muscle and fascia. I suppose she got rid of probably a pint of fecal material, and I hoped that its removal might bring about some improvement in its condition, but was informed later that she gradually sank and died this evening. She had no further obstructive symptoms at any time and her abdomen was not distended when I saw her; on the contrary it was scaphoid. I think that there is no doubt that this death resulted from toxæmia, the result of extravasation of intestinal contents around the anastomosis.

There are a number of practical points in regard to resections of the colon about which there is great variety of opinion and practice, and most of these points are brought out in the foregoing cases. Using these as a basis, I propose to discuss the following questions. First, where should incision be made in operating for diseases of the colon? Second, is one justified in doing a resection and an anastomosis in the presence of acute obstruction, or should the obstruction first be relieved by drainage? Third, what are the relative merits of end-to-end and lateral anastomosis? Fourth, what is the best method of making the anastomosis? Fifth, should drainage be used if the peritoneum is not already infected? Sixth, to what is the operative mortality due? Seventh, is ultimate mortality due to too limited excision of the bowel?

1. In answering the first question I would say that the incision should be made as nearly as possible over the growth, and if one has been unable to locate the growth, and operates simply for the obstruction, and finds that he is unable to gain ample access to the involved bowel, then a second incision, through which the bowel may easily be drawn, should be made. A second incision is much less objectionable than the injury to the bowel through an incision which does not permit of easy handling.

2. Regarding the second question, as to resection and anastomosis in the presence of obstruction, there can be little doubt, all surgeons having agreed that however easy the

operation is it should never be done. This conclusion was reached after sad experiences, to which I think my first and second cases and possibly my tenth case, might be added. In 1903 F. T. Paul (*Brit. Med. Jour.*, Aug 15, 1903) said that obstruction more than trebled the danger of colon resection, and he reminded us that even after a simple colostomy, done for obstruction of two or three days' standing, the patient may be in a precarious state for two or three weeks, even though apparently greatly improved for twenty-four hours. There is sufficient auto-intoxication, even when the drainage operation is done fairly early, to cause severe poisoning which is characterized especially by a foul diarrhœa, loss of appetite, slight fever and general depression. This condition is well shown in Case VIII of my series, and is a picture, I am sure, familiar to us all. Not only is the patient absorbing toxins from the intestinal fermentation, but ulceration of the colon, well above the obstruction, in these cases is quite common. To do a formal resection, however quickly and easily, at this time is to invite disaster. Moynihan ("Abdominal Operations") says, "There are few rules so binding upon the surgeon as that which prohibits the resection of growths and subsequent end-to-end anastomoses of the large intestine in cases of acute obstruction." One is strongly tempted to break this rule when the growth is easily accessible, as it is in the transverse and sigmoid colon, but there is every reason why he should refrain. Experience has taught surgeons everywhere this lesson, and it should not be forgotten.

A few successful resections and anastomoses of the upper portion of the small intestine for acute obstruction may mislead the operator to the false conclusion that the same procedure will work as well in the case of the colon, but the question is an entirely different one. The small upper portion of the intestine is comparatively free from bacteria, while the tract of the large intestine teems with them, and it is this fact that accounts for the peritonitis so frequently observed in cases of long standing obstruction of the lower intestine. The bowel wall becomes distended, its circulation bad and the organisms make an easy exit into the peritoneal cavity. It is a well-known fact that the lower down in the intestinal tract an obstruction is the greater is the infection from the absorption of the intestinal contents, and this is due not to the greater absorbing area but to the greater number of pathogenic organisms in the lower portion of the small intestine and colon. Numerous have been the contributions to surgical literature in recent years showing the danger of this absorption even after a perfect resection and anastomosis. Monks and others have laid great stress upon the importance of emptying the bowel above the obstruction at the time of the operation, and his work and experiments in this matter have contributed largely to our improved results. He has shown us how a large portion of the small intestine can be emptied by puckering the intestine up on a large blunt tube passed into its interior, and that this is the only way in which it can be accomplished. The toxicity of the intestinal contents in acute obstruction is well shown by the experimental study made by Clairemont and Ranzi ("Proceedings of the German Medical Congress, 1903"; ANNALS OF SURGERY, December, 1903.). Their results are as follows: "The intestinal contents above the stenoses, after being rendered free from bacteria by filtration, always proved poisonous, whether administered intravenously or hypodermatically. Bouillon cultures of small quantities of the intestinal contents after four to five days gave toxins equally poisonous. Thus the poison is the result of bacterial growth. It can also withstand heat. The toxic action can be paralyzed by mixing the material with the brains of normal rabbits or guinea pigs. The filtered intestinal contents in some instances showed intense hæmolytic power when administered to dogs or horses. It was impossible to establish either active or passive immunity to the poisons, which seem to show that an extension of serumtherapy to the treatment of ileus is impossible." William J. Mayo (*Jour. Amer. Med. Assoc.*, September 14. 1907) says that a fair proportion of the mortality following resection for obstruction is due to perforation from thrombosis, and he therefore urges great care in the handling of the distended bowel on this account. He advises tracing the collapsed bowel up to the obstruction rather than the distended bowel down to the obstruction. Here, then, we have another reason for primary drainage of the large intestine in cases of obstruction before doing an anastomosis.

I think my own cases bear out all these points. In two I did a resection in the presence of an acute obstruction and lost both. In two others I did the drainage operation first and the resection later. One died and one recovered. In my last case I did a primary resection because I thought that as the obstruction was not complete there would be little danger from auto-intoxication, the result of absorption. As I have said before, this, I believe, was an error. What then should be the procedure in these cases of acute obstruction? Moynihan recommends Paul's operation, which consists in loosening the bowel from its attachment, bringing the growth out through the wound, dividing the bowel well above and below the growth, and inserting into the proximal and distal ends two glass tubes connected with a rubber drainage tube, and then the removal of the growth. By this operation the growth is removed at once and free drainage of the bowel is accomplished. Later, an anastomosis is accomplished by a crushing forceps and the fecal fistula closed. Von Mikulicz, Hartmann, and Mayo, all suggest methods quite similar to those of Paul. There is no doubt that these methods are superior to colostomy performed above the growth, as it renders subsequent operation very simple and easy. Where the growth cannot be delivered easily into the wound colostomy may be done or the obstructed portion of the colon may be side-tracked by performing ileocolostomy or colocolostomy. This method I pursued in one of my successful cases (Case VII). These operations are particularly advised where the obstruction is only partial, and sometimes are advantageous where there is no obstruction.

3. The relative merits of the end-to-end and lateral anastomoses depend largely upon the portion of bowel with which one is dealing. As a rule there is greater likelihood of leakage in the end-to-end operation because of the difficulty of getting an accurate and tight approximation of the two por-

tions at the mesenteric attachment. It can, I think, be said that unless the peritoneal coat can be brought in from the two lateral aspects and made to cover the divided mesenteric attachment a lateral anastomosis should be done. In the ascending and descending colon, and at the hepatic and splenic flexures, a large portion of the posterior aspect of the bowel has no peritoneal coat, and the mesentery is short and wide, so that here there is no chance of making a complete peritoneal approximation in an end-to-end anastomosis, and therefore the lateral method must be employed. In the transverse and sigmoid colon the entire bowel is covered with peritoneum, and it can be drawn in over the mesentery. It is only in these situations that the end-to-end method should be used. Even in the transverse colon and the sigmoid, I would prefer the lateral approximation. In resection of the cæcum, the ileum should be anastomosed with the transverse colon under the omentum, and by the lateral method. End-to-side anastomosis is more difficult and not, I think, as satisfactory. Another great advantage of the lateral anastomosis is that if properly done there is little drag upon the line of suture. In order to prevent this drag the two portions of bowel beyond the anastomotic opening in both directions should be approximated by several interrupted sutures. Many of the failures due to leakage in end-to-end anastomoses have occurred because an unhealthy portion of bowel was involved in the anastomosing sutures. This is much less likely to occur in the lateral anastomosis, and the surgeon knowing that he is going to perform a lateral anastomosis is much less likely to leave any of the diseased bowel. The argument that more time is required for the lateral anastomosis, is without weight as a rule. Still another point in favor of the lateral anastomosis is that there is no danger of stricture developing at the line of anastomosis, as there certainly is in an end-to-end suture. Moynihan lays great stress upon the importance of dividing the bowel obliquely, especially where an end-to-end anastomosis is to be made, as in this way there is less danger of including in the sutures a portion of intestine the circulation of which may be impaired. He reports that he has done seven resections of the cæcum and ascending colon with end-to-end anastomoses. In this series there was one death due to leakage. His more recent practice is to employ the lateral anastomosis. Bilton Pollard (*Brit. Med. Jour.*, Jan. 23, 1904) advocates the end-to-end method and reports several successful operations done for carcinoma. Another strong advocate of operating in two or more stages is Neumann (*Deut. Med. Wochenschr.*, xxxii, No. 14), who details six cases of carcinoma of the colon in which he first practiced drainage and later resection. His results would certainly warrant his conclusions. Jonas (*Jour. Amer. Med. Assoc.*, Sept. 15, 1906) reports 16 cases of cancer of the colon in 15 of which resection was done. In this series he had 12 operative recoveries and three deaths. The three deaths were all due to a leakage at the point of anastomosis, and in each of these a Murphy button had been used.

In the first three of my own cases I did an end-to-end anastomosis; death occurred in one eight hours after operation, and leakage in the other two; in one a Murphy button was used, and perforation took place and the button dropped out of the bowel into a pocket behind it. Death occurred on the twenty-third day. In the third case simple suture was used, and the patient recovered in spite of a fecal leak and remains well to-day. In the last seven cases lateral anastomosis with simple suture was done. Leakage occurred in three and death in two cases. One died on the twenty-fifth day and one on the fourteenth. My own experience, then, tends to confirm that of the other operators already quoted who favor lateral anastomosis.

4. As regards the best method of making the anastomosis, I would say that it is difficult and practically useless for one operator to say what is the best method of suture to be employed by another in making intestinal anastomoses. I would advise one to use that method with which he is most familiar and which has given him the best results. There is one exception to this statement, however, and that is that some method of suture is far preferable to any mechanical device such as a button or a bobbin. I employed the Moynihan

operation, done with the aid of the Doyen forceps, in all of my cases excepting Case III, in which the Murphy button was used with subsequent necrosis and perforation. In my recent cases I have used a through-and-through suture of catgut and reinforcing suture of celluloid thread or silk. Some such forceps as those of Doyen facilitate the operation considerably, as they control the fecal current and also enable the operator to manipulate the bowel with the least possible traumatism. I have never used the Magraw suture, but those who have speak well of it. Most surgeons have now become convinced that the large intestine is no place for the Murphy button, and no one has tried to impress this upon the profession as much as Murphy himself. He states ("Year Book of Surgery, 1908") that for years he has advised against the use of the button in large intestine anastomoses excepting possibly in lateral anastomoses high up in the colon, and in these cases the oblong button should be used. This advice probably answers the question as to the utility of the button in these cases—and my own experience confirms it. Numerous cases have been reported in which the button has either become blocked by a mass of fecal matter, or in which pressure from it has produced necrosis and leakage. This is well illustrated in my second case.

5. Should drainage be used if the peritoneum is not already infected? This question is not so easily answered. Given a case in which there is no obstruction, no peritonitis, the bowel wall healthy at the lines of resection, and the intestinal tract well emptied before operation, I should use no drainage. This proposition, however, presumes an early diagnosis, which is by no means a rule in cancer of the colon, and a thorough preparation of the patient before the operation. In but two of my cases did I close the abdomen without a drain; one got well in spite of a leak, and is well to-day, four years after operation; the other died on the fourteenth day with leakage due to sloughing of the bowel at the line of approximation. This was Case X, and I believe that it might have been saved had a Paul's operation been performed instead of an immediate anastomosis. In the

eight other cases I used drainage and had a fecal leak in but three; one was the case in which the Murphy button was employed, and who died on the twenty-third day; another recovered in spite of the leak, and the third died on the fifth day. I believe that leakage does not depend so much on drainage or no drainage as on the character of the intestine and the accuracy of the suture. My own greatest error in this series was in doing resections without first draining the bowel thoroughly, the result of which was that the proximal portion of the bowel was in poor condition and the anastomosis put to the severe test of having to stand at once the strain of the passage of hard masses of fecal matter and a quantity of irritating and septic intestinal contents. I believe on the whole that drainage is better than no drainage in large intestinal anastomoses. The drain should be a small one and should not rest directly upon the line of suture, as this only invites a leak.

6. To what is the operative mortality due? One of the surprising lessons learned from the study of my own cases and from those of others is that the immediate operative mortality is remarkably small, and that the late operative mortality is large. In my ten cases I have had five operative deaths. Case I died eight hours after his operation, when he was suddenly taken ill with cardiac symptoms. At the autopsy in this case the patient was found to be suffering from a marked endocarditis; he also had a large aneurism of the thoracic aorta. Dr. Longcope thought that the cardiac condition alone was enough to account for the sudden death. There was peritonitis at the time of operation in this case, and even if the patient had not died of his cardiac condition I think that he might have died of the peritonitis. Case II died on the twenty-third day after operation, from infection due to necrosis of the bowel with fecal leakage. Case VI died on the sixth day after operation, apparently from septic intoxication. Case VIII died on the twenty-fifth day after operation, from a low grade infection and fecal fistula. Case X died on the fourteenth day from the same cause. It will be observed that there was but one prompt death after the

operation, and that from a cardiac condition, and that there were but two deaths within the first week. It is apparent, then, that the operative mortality is due to conditions which do not produce death under a number of days. In other words, the shock in spite of the prolonged operation, the age of the patient and even his bad condition, is not a significant factor in the mortality. The deaths result most frequently from necrosis of the bowel and leakage, and this necrosis in most instances is due not to a faulty method of suture but to the fact that the proximal portion of the bowel is in bad condition from either complete or incomplete obstruction. I am convinced that if the bowel was drained more frequently before the anastomosis was done the operative mortality would decrease considerably. The best operative results have been obtained where this primary drainage was employed. Moynihan has collected 100 cases of resection for malignant disease of the colon from recent literature, the results of which are particularly interesting. In 68 cases a primary resection was done with 22 deaths, a mortality of 32.3 per cent.; in 12 Paul's operation (resection and drainage followed later by anastomosis) was done with one death, a mortality of 8.3 per cent.; in 17 colostomy was done first and resection later, with 3 deaths, 17.6 per cent.; in 3 ileocolostomy followed by excision, one death, 33.3 per cent. The ultimate results in these cases are given in answer to the last question.

7. Is the ultimate mortality due to too limited excision of the growth? I do not believe that it is. Most of the recurrences that have taken place have not developed at the site of the previous resection. It is well known that glandular involvement in carcinoma of the colon takes place very late as compared with malignant disease elsewhere. In fact, obstruction often occurs before any extensive glandular involvement has taken place. Again, we all realize the importance of going well above the seat of disease, and many times we are compelled to make wide excisions because of the poor circulation of the proximal portion or because of the inaccessibility of the colon near the growth. In cancer of the cæcum the entire ascending colon should be removed, if for no other

reason than because an anastomosis between the ileum and transverse colon is better than an anastomosis between the ileum and the ascending colon. In cancer of the hepatic flexure the ascending colon and cæcum should be removed for the reason that ileocolostomy is of easier performance and produces better results than an anastomosis between the ascending and transverse colon. William J. Mayo reminds us that in 4 cases out of 5 the middle colic is the sole blood supply of the transverse colon, and unless these vessels are involved they should be preserved, else the whole transverse colon will become necrotic. In my series of 8 resections for cancer 3 recurred and one died one year after operation from recurrence without obstruction. Case IV died nearly two years after the excision of the cæcum for tuberculosis and 20 days after a second excision of the transverse colon for the same condition. Three patients are well at the present time. Case III, one of carcinoma, is well four years and two months after operation; Case VIII, one of carcinoma, is well fourteen months after operation, and Case IX, one of tuberculosis of the cæcum, is well four months after operation.

In close accord with my own results are those reported by Völcker (*Presse Médicale,* Oct. 10, 1908; "Year Book," Murphy, 1909) from the Heidelberg Clinic. He gives a study of 101 cases of cancer of large and small intestine, and concludes his paper with the statement that resection of the cancerous intestine is a very serious operation (50 per cent. mortality), but the patients surviving have a good chance of permanent cure (10 out of 17 survivors, 58.8 per cent.). In Moynihan's table of 100 cases he referred to the after history as given in 64 of the 73 cases which recovered from the operation: 17 were well at the end of six months; 15 at the end of one year; 15 at the end of two and a half years; 4 at the end of three years; 2 at the end of four years; one at the end of five years and 2 at the end of seven years. It will appear, then, that if we can improve our operative mortality our ultimate mortality will compare favorably with that following operations for carcinoma elsewhere.

LARGE PHAGEDENIC ULCER OF ABDOMEN.

BY WILLIAM HENRY LUCKETT, M.D.,

OF NEW YORK CITY.

We use the word "phagedenic" in the title advisedly, for lack of a better term to describe a rapidly progressing ulcer of a gangrenous nature. Most text-books of to-day describe phagedenic ulcers in the past tense, so to speak, and put the condition in the same category as malignant syphilis, hospital gangrene, malignant œdema, etc., usually ending by saying that the condition is "chiefly found in tropical countries," "is rarely seen to-day," and is accompanied by "great pain and high fever," etc. Gangrene in some form or other is an ancient disease; it is mentioned in the papyrus Ebers, and both Hippocrates and Galen describe and recommend treatment for this condition. That the case herewith reported is nevertheless a rare one to-day, is substantiated by the fact that in a very large and active hospital and clinical service of fourteen years we do not recall seeing a similar case. This, together with the very unusual site and extraordinarily large size, engages special interest.

Case.—A. K.; fifty-five years old; gardener by occupation; was admitted to my service at Harlem Hospital May 30, 1908, with the following history. Six days ago picked with finger nail a small pimple on skin of the lower part of abdomen on the left side. The following day noticed that a scab had formed over this point, which upon removal with finger nail disclosed a small ulcer. This ulcer has been rapidly increasing in size ever since, and is accompanied by intense itching and considerable pain. Denies gonorrhœa or syphilis.

Physical Examination.—Male adult, medium frame, poorly nourished, conscious, rational, but very irritable and excited and in great pain. Pupils react sluggishly; mucous membranes pale but moist; tongue coated; pharynx red; pulse fair size and force, tension above normal. Heart sounds of fair force; lungs clear;

liver, spleen, and kidneys normal; reflexes diminished; no bone pains or tenderness. Abdomen hard, somewhat retracted, and presents an ulcer with its centre on about the lower one-third of a line between the umbilicus and the anterior inferior spinous process of the ilium, oval in shape, longest diameter transversely, about 2 x 3 inches in size.

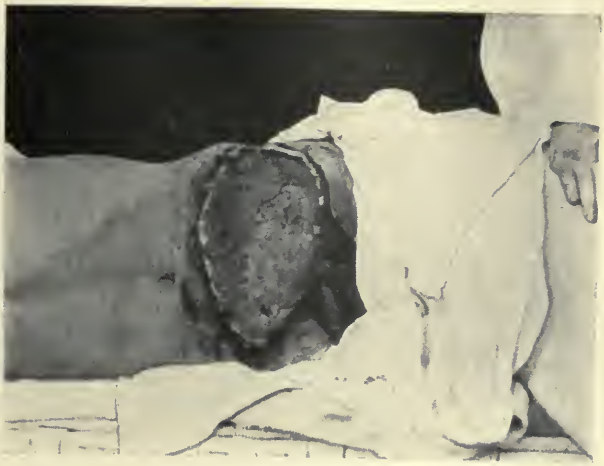
The centre of the ulcer presented a small round area of grayish, sluggish, low grade of granulations, about one inch in diameter. Surrounding this was a black ring of gangrenous skin, dry outside, moist and undermined and irregularly attached beneath, with small honey-combed sacculations of thick sloughy pus. The outer edge of this black ring was rather firmly attached to the adjacent skin, and although the demarcation was sharply defined, it would bleed if detachment were attempted. The circumferential adjacent skin was red, slightly raised and inflamed, but not undermined.

The ulcer was irrigated with hot potassium permanganate, 1 : 10,000 solution, and dressed with bichloride solution, but it continued to spread with, almost visible, frightfully rapid progress from day to day, always preceded by the ring of juxtaposed inflamed skin. Vigorous antispecific treatment exhibited without effect. Temperature continued high, pain great.

June 6, 1908, ulcer measured 4 x 8 inches; June 10, measured 5¼ x 10 inches. It was observed that the ulcer, while it remained more or less oval, spread transversely across the abdomen with considerably more rapidity than in an ascending or descending direction, and when the lower border of the ulcer reached the hair line of the pubes, its downward encroachment apparently was entirely checked; although it continued to spread upwards towards the umbilicus, it did so slowly. In other words, after the lower border of the ulcer was halted at the hair line, its extension or progress was upwards in an eccentric rather than concentric manner.

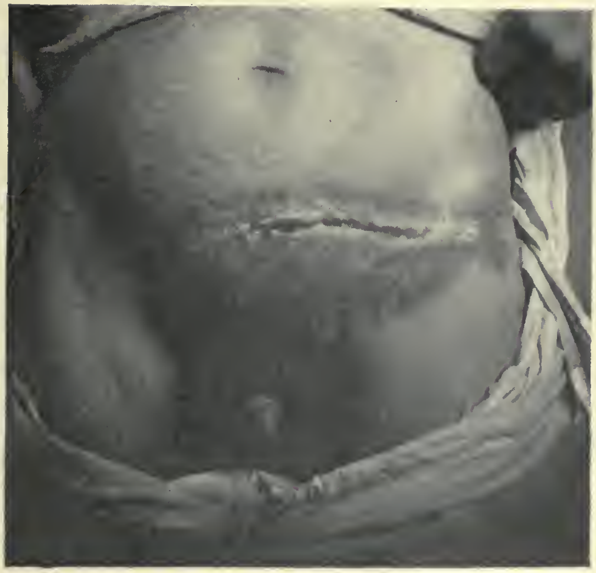
This upward and lateral extension of the ulcer cannot be explained on anatomical premises, for the extensive network and stems of the subcutaneous lymphatics of the abdominal wall below the umbilicus, the infra-umbilical region, pass downwards and forwards, parallel with the ilium, and empty into the inguinal nodes. So it will be seen that the more rapid spread of the ulcer, contrary to what might be reasonably expected, was against the

FIG. 1.



Phagedenic ulcer of abdominal wall.

FIG. 2.



Cicatrix after healing of ulcer.

lymphatic stream. It is indeed a curious point in this connection to note that the inguinal glands were never enlarged.

June 9, a blood count showed only a very moderate leucocytosis: W.B.C. 12,000, R.B.C. 4,200,000; differential: polymorphonuclears 78 per cent., lymphocytes 17 per cent., mononuclears 4 per cent., eosinophiles 1 per cent.

June 2, 1908, culture made from ulcer showed presence of *Staphylococcus aureus.* June 4, 1908, Dr. Humphreys, the hospital pathologist, reported diagnosis:

"*Phagedenic Ulcer of Abdominal Wall.*—Film preparations from purulent material at centre of slough show many pus cells, very many staphylococci, and a *few* long spindle-shaped bacilli, the latter showing numerous clear spaces in their protoplasm (spores?). Aërobic culture shows merely *Staphylococcus aureus,* the bacilli failing to grow. Similar preparations made from serosanguinous discharge at edges of ulcer show many more spindle bacilli, indicating that these are the primary infective agents. Anaërobic cultures taken and will be reported later. In my opinion, the infection probably belongs to the heterogeneous class, known as soil or dirt infection, to which belongs chancroid, phagedena, malignant œdema, etc. The organisms of this class in general are anaërobic spore bearers, inhabiting rich soil, etc. Owing to the difficulties of artificial cultivation, their specific characters are but little known. The staphylococci are probably of only secondary significance.

"The patient's occupation, gardener, and the location of ulcer, waist band, as well as his general arteriosclerotic condition and poor nutrition, seem to me to be of especial significance in this connection. No spirochæte to be demonstrated."

June 6, Dr. Humphreys reported: "Anaërobic culture overgrown by *Staphylococcus aureus.*"

The ulcer continued to spread, resisting all external and internal treatment administered, including some highly reputed, especially efficacious "special treatment for ulcers," until June 12, when it measured 5¼ x 10¼ inches, reaching as it did from near the anterior superior spinous process on the right across the abdomen to beyond the same on the left. Temperature 104°, pulse rapid, patient delirious and rapidly becoming seriously and profoundly asthenic.

June 13, it was decided to treat the case wholly on surgical grounds and to totally ablate the ulcer by actual cauterization. Patient was etherized. The entire ulcer, including the skin beyond the inflamed ring, was thoroughly cauterized. The extent and magnitude of this procedure can be more fully grasped when we mention that we consumed the benzine of two freshly filled Paquelin thermocauteries in a period lasting fifty-five minutes. The cauterized surface was thoroughly swabbed with pure carbolic acid, which in turn was washed with alcohol, and a mild bichloride wet dressing applied.

Reaction after the operation was complete, nice clean granulations quickly replaced the eschar, cicatrization was rapid, patient began to improve in every way. Temperature normal in a few days after operation, and recovery was complete and rapid, without a single setback in the way of a reappearance of the former disease.

Fig. 1 shows ulcer nearly at its height of development; Fig. 2, ulcer healed. Note the small size of the contracting cicatrix.

Conclusions.—Procrastination and temporizing with ineffectual internal medication and external dressings came near to losing the patient. Such rapidly extending ulcers should at once be thoroughly ablated with the actual cautery.

INGUINAL HERNIA IN THE FEMALE.

BY WILLIAM B. COLEY, M.D.,

OF NEW YORK,

Attending Surgeon to the General Memorial Hospital; Associate Surgeon to the Hospital for Ruptured and Crippled.

INGUINAL hernia in the female constitutes a fairly large percentage of the total number of cases of hernia observed. At the Hospital for Ruptured and Crippled during the last twenty years, we have had 59,404 cases of inguinal hernia of which 9082 were in the female.

Championniere was the first to point out the excellent results that could be obtained by operation, and was one of the first to report a considerable number of cases.

With the help of Dr. D. H. M. Gillespie, I have made an analysis of 1692 cases of inguinal hernia in the female observed at the Hospital for Ruptured and Crippled, with the view of determining, as far as possible, at what period of life the hernia occurred. A special effort was made to ascertain in how many cases of hernia in adult life the hernia had existed in infancy or early childhood. These statistics show that it had so existed in 66 out of 1085 cases, or in 6 per cent. of the cases. It is probable that in a very considerable number of other cases the hernia had actually been present during infancy or childhood, but had been forgotten in the long interval that had elapsed.

TABLE I.—AGE OF PATIENTS AT TIME OF FIRST VISIT TO THE HOSPITAL.

	Single.	Double.	Total.
Up to 1 year of age	140	24	164
1 to 5 years of age	171	21	192
5 to 10 years of age	150	32	182
10 to 14 years of age	56	4	60
15 to 21 years of age	83	11	94
21 to 31 years of age	164	30	194
31 to 41 years of age	254	57	311
41 to 51 years of age	177	54	231
Over 51 years of age	185	70	255
Age not stated	6	3	9
	1386	306	1692

TABLE II.—CASES KNOWN TO HAVE HAD A HERNIA AT 14 YEARS OF AGE.

	Per cent.
34 of 94 between 15 and 21 years of age	36.1
19 of 194 between 21 and 31 years of age	9.8
8 of 311 between 31 and 41 years of age	2.5
2 of 231 between 41 and 51 years of age	.8
3 of 255 over 51 years of age	1.2
66 of 1085 cases	6.

ANATOMICAL VARIETIES—INDIRECT OR OBLIQUE HERNIA AND DIRECT HERNIA.

Some writers [1] state that direct hernia in the female is even more frequent than in the male. Our observations at the Hospital for Ruptured and Crippled are entirely at variance with this view. In making an estimate of the relative frequency of the two varieties one can consider only such cases as have been subjected to an operation, inasmuch as a positive diagnosis cannot be made without operation. Yet, the writers who believe that direct hernia in the female is comparatively frequent, pass their opinion upon a clinical diagnosis alone, unconfirmed by operation.

I have personally operated upon 353 cases of inguinal hernia in the female, of which 170 were adults and 183 children, and only 2 in this entire series were direct herniæ. Both of these cases occurred in adults; one was operated upon six weeks ago, a double inguinal hernia with the bladder in the sac on the right side. This gives a proportion of six-tenths of one per cent., or, if we count the adults alone, as there are practically no direct herniæ in children, it is 1.2 per cent. Comparing this with the cases of direct hernia in the male, I have operated upon 1776 cases of inguinal hernia in the male, of which 815 were adults; 961 children. Of these I have observed 50 cases of direct inguinal hernia, or about 3 per cent. If we consider adults alone, which is the only correct way, we have 5.5 per cent. in male and 1.2 per cent. in the female, which would make direct hernia in the male occur 5 times more common than in the female.

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[1] Escher, Deutsch. Zeit. f. Chir., 1899. B. iii, 53, H. 5.

Etiology.—I believe that inguinal hernia in the female, or at least all cases of oblique inguinal hernia in the female, are due to a persistence of the process of peritoneum known as the canal of Nuck, which corresponds almost exactly with the vaginal process of peritoneum in the male. That this process remains patent in many children long after birth, even into adult life, has been proven by a large number of investigators.

That the formation of the canal of Nuck is similar to the formation of the vaginal process of peritoneum in the male, is disputed by a number of writers, some, *e.g.*, Martin and Waldeyer, holding that this canal is a normal occurrence; others, like Duplay, believe it to be anomalous.

My own belief, based upon a careful study of 350 cases of inguinal hernia in the female, operated upon personally, is that the canal of Nuck is a normal development, which remains open in all cases in which a hernia subsequently develops as well as in many other cases that never have a hernia. This congenital process of peritoneum, by its failure to close I regard as the great and all-important cause of inguinal hernia in the female, as well as in the male, although in addition there are usually present various exciting causes, such as persistent crying in infancy and young children, straining of stool, heavy lifting, and coughing in adult life.

Karl Hemmerdinger in his inaugural dissertation (1902) speaks of the relation between congenital inguinal hernia and the descent of the testis or ovaries and the patency of the vaginal process of peritoneum in the male and the so-called Nuck's diverticulum in the female. He enters somewhat fully into the history of the development of the inguinal region, a knowledge of which is necessary in order to understand the mechanism of congenital inguinal herniæ.

Careful examination of an embryo eight weeks of age, shows at the lower end of the primitive kidney a second peritoneal fold running toward the inguinal region. This fold includes a rather coarse band of connective tissue, called the inguinal band, or cord of the primitive kidney. The same plays an important rôle in the development of the male and female genital organs. In man it later becomes Hunter's gubernaculum; in woman, the round ligament.

The ovaries, the same as the testicles, undergo considerable change of location in their descent. In the third month of embryonic life they pass from the lumbar vertebra into the small pelvis. It is upon this descent of the ovaries that the above described inguinal band of the primitive kidney (which is also present in the female) is destined to act. During this process the inguinal band separates into three sections and enters into firm union with Müller's ducts at the point where they combine and form the sexual cord. The upper section, consisting of smooth muscle fibres, originates in the parovarium and is embedded in the hilus of the ovary. The continuation of this section is the ovarian ligament, and this, passing into the third and most highly developed section of the inguinal cord, forms the round ligament.

As to the origin of the canal of Nuck, Hemmerdinger believes that it is produced by the same causes that are responsible for the vaginal process in the male, even though there be apparent differences.

According to Bramann's observations, the vaginal process in the male originates in the following manner:

In the beginning of the seventh month of embryonic life a small indentation of the peritoneum occurs at the spot where the gubernaculum leaves the abdomen; at the same time the testicle passes into the scrotum. As the testis descends, the above-mentioned indentation becomes elongated. The same factor that causes the testicle to be drawn into the scrotum, elongates the small peritoneal sac lying before it. If this agent ceases to exert traction upon testicle and peritoneal sac, the latter's descent is arrested.

Thus, the peritoneal diverticulum is present before the testicle begins to traverse the abdominal walls. Hence, the vaginal process cannot be considered the result of a bulging of the peritoneum caused by the testicle. On the contrary, the testicle and vaginal process are united, and descend together.

The agent which draws downward the testicle and at the same time forms the processus vaginalis, has been called by Soulie, *un cordon cellulaire plein* (a plain, cellular cord). This cord may cause a diverticulum of the peritoneum and leave the testicle within the abdomen. Many of my cases prove the truth of this opinion.

In an analogous manner the same cord causes a protrusion of the peritoneum in the female, which is then called Nuck's diverticulum. Hence, both vaginal process and Nuck's diverticulum are due to the same cause in man and woman.

Herman Meyer of Zurich has made extensive investigations as to the relation of such peritoneal diverticuli to the development of inguinal hernia. He found in a new-born dog on either side of the abdominal wall an opening which led into a diverticulum 9 to 12 mm. in length; the same was situated outwardly and in front of the round ligament.

In the female fœtus of three to eight months, he found the same diverticulum six times, ranging in length from 1.75 to 10 mm., and in relatively the same position to the round ligament.

In new-born children and infants, Zuckerhandl found the canal of Nuck open in 37 per cent. of the cadavers examined; Féré in 9.2 per cent., sometimes on one side only, sometimes on both.

The reason many writers fail to recognize this canal is that the abdominal opening is difficult to find. Nobbe states that even in those cases in which the entrance to the vaginal process is relatively wide, the communication between the diverticulum and peritoneum is not always promptly found, as the cavity is covered by a fold of peritoneum and the transverse fascia. Only in the eighth cadaver examined (a girl three-fourths of a year old) was Nobbe able to recognize a canal of Nuck open on both sides. The diverticulum on the right side was 16 mm. in length and 3 mm. wide; the entrance opening was 8.5 mm. wide. On the left side the diverticulum was 17 mm. long; entrance opening 2.5 mm. and canal 3 mm.

According to Sachs the obliteration of the vaginal process is due to granulation.

Féré found in one case in the entrance opening a protruding mass the size of a millet seed, which he interpreted as an exudate causing the obliteration. This obliteration may be complete or partial, which enables one to explain the different shapes of the hernial sac in external herniæ and hydroceles.

As regards the frequency of the patency of the vaginal process of peritoneum, Hemmerdinger states that this increases with advancing age. In the first ten to twenty days after birth obliteration proceeds very rapidly and comes to a completion in about 50 per cent. of the cases. From the twentieth to the thirtieth day after birth, the number of cases with total obliteration is much smaller, while there is a marked increase in the cases with an entirely open vaginal process.

Camper found in a series of 70 new-born babies, both vaginal processes open in 34; the right vaginal process in 14 and the left vaginal process in 8 cases.

Zuckerhandl examined 100 children during the first three months of life and found in 57 infants an unobliterated vaginal process on both sides in 20; on the right side in 12 and on the left side in 5 cases. In 188 children up to 3 years of age, examined by Féré, the vaginal process was found partially obliterated on both sides in 11, on the right side in 16 and on the left side in 14. In 18 obliteration had not taken place at all.

Of these 59 cases 32 were below 1 month of age, 6 from one to three months and only 10 were above six months.

From the above investigations it appears that the vaginal process of peritoneum becomes obliterated earlier on the left than on the right side, which may be explained by a later descent of the right testicle.

Similar conditions obtain as regards the canal of Nuck in the female. Hugo Sachs who examined 100 children within the first year states "The persistence of the canal of Nuck is much rarer than that of the vaginal process in the male. In 75 per cent. of these children Nuck's diverticulum was obliterated at the moment of birth. Whenever it was not obliterated at that time, it showed very little inclination to become obliterated later."

Nobbe arrives at the following conclusions, based upon his own investigations as well as a study of the literature: (1) The canal of Nuck is found in about 8 to 10 per cent., while the vaginal process is found open in 30 to 40 per cent. (2) Obliteration occurs usually post partum, rarely ante partum. (3) The diverticulum is generally found open on both sides; more rarely it is found open on one side. If the canal does not become obliterated, it represents a preformed passageway for the herniæ.

Frequently the cavity of the vaginal process in the female becomes filled with a serous fluid (hydrocele muliebris).

Hemmerdinger reports the history of a case of hydrocele in the female observed at the Freiburg Clinic. Hydrocele in the female is not so exceedingly rare as was formerly believed. Wechselmann[2] in 1890 reported 62 cases, and in 1892 I published 15 cases observed at the Hospital for Ruptured and Crippled. In 353 adult cases of inguinal hernia in the female which I operated upon, hydrocele of the canal of Nuck was found in 11 cases.

As regards the etiology, I believe with Hemmerdinger, that hydrocele of the canal of Nuck is due simply to a failure of the diverticulum of Nuck, or the processus vaginalis, to completely close. The condition is really never more than an accumulation of fluid in the lower end of an actual or potential hernial sac.

E. Scott Carmichael of Edinburgh, has contributed some valuable facts upon inguinal hernia in the female (Trans. of the Medico-Chir. Soc. of Edinburgh, 1905–6, p. 226). His conclusions are based upon a statistical study of 729 radical operations in both sexes, treated by Harold Stiles and himself. In this series of cases 5 to 10 per cent. occurred in the female. In 184 radical cures performed by Carmichael in children, 23 were females. Of the 729 radical operations in both sexes, 76 were in girls, giving a percentage of 10. 21 were under one year of age; 21 were under five years of age, and 34 were over five years of age. 39 were on the right, 24 on the left side, and 13 double.

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[2] Arch. f. klin. Chir., 1890, 40, 578.

A study of the contents of the sac is of great interest. The following contents were either found in the sac or could be pulled down into the sac in 28 cases:

Fallopian tube and ovary	17
Fallopian tube alone	5
Small intestine	2
Omentum	2
Cæcum and ovary and Fallopian tube	1
Vermiform appendix and ovary and Fallopian tube	1

In two cases the sac was tuberculous.

Carmichael states that it is suggestive that the persistence of the so-called canal of Nuck should be associated in such a large percentage of cases (over 30 per cent.) with malposition of the ovary and Fallopian tubes. In the young child the position of the ovaries and tube shows great variation. Sometimes the ovary lies longitudinally along the lumbar vertebræ, resting on the psoas muscle; again, it may be found on the false pelvis or in the cavity of the true pelvis. Carmichael believes that the action of the gubernaculum or inguinal ligament may be in some way responsible for the position of the ovary. He does not believe that it is possible to explain the presence of the ovary and Fallopian tube in 24 cases out of 28 by simple mechanical causes, but thinks that in some way it is associated with the development of the inguinal ligament. That the formation of the canal of Nuck is analogous to the processus vaginalis in the male, Carmichael believes to be doubtful.

He regards the canal of Nuck an abnormal protrusion, associated with the development of the inguinal ligament. He points out the fact that the ovary and tube do not lie free in the sac in the same sense as a loop of intestine and omentum, but are intimately associated with its wall, the broad ligament or mesosalpinx springing directly from the posterior aspect of the sac. The relation of the ovary to the sac very closely resembles that found between the sac and the cæcum and sigmoid.

Lockwood regards ovarian hernia due to abnormal length of the mesovarium or mesosalpinx. Carmichael's series of cases does not support this view. His cases show a large percentage of inguinal hernia in the female to be bilateral. In babies under one year, of 21 cases 8 were double; of 21 under five years, 2 were double; of 34 over five years, 3 were double.

A much greater frequency of ovarian hernia in the very young is also shown by Carmichael's statistic:

In 21 under one year, ovary and tube were found in 13 cases; in 21 under five years, ovary and tube were found in 7 cases; in 34 over five years, ovary and tube were found in 2 cases.

The very large proportion of ovarian herniæ shown by Carmichael's statistic is probably due to the fact that 21 out of 76 patients were individuals under the age of one year; 21 others were under five years.

Practically all of my cases were over four years of age, and 170 of them were in adults. While I have seen a considerable number of cases in infants and young girls in which I was able to palpate the ovary, in only a very small proportion of the older patients was the ovary found at operation.

Bladder hernia in my own experience is an extremely rare condition in the female. My series of 350 cases shows only two examples of bladder hernia, both of the paraperitoneal variety. In both of these cases the hernia was of the direct type.

Eggenberger (*Deutsche Zeit. f. Chir.*, Oct., 1908) whose paper upon bladder hernia gives the most recent and most complete statistics of the subject, was able to add 110 cases to the 182 cases twelve years previously collected by Brunner. The sex is given in 241 cases, 168 of which were males, 73 females. While Brenneisen gives the proportion of male to female cases as 3:1, Eggenberger's personal statistic shows a ratio of 3 males to 2 females. Of the male cases, 55 were inguinal, 5 femoral hernia; of the female cases 15 were inguinal, 23 femoral hernia.

I have personally never seen a cystocele in a femoral hernia. One of my cases, a large irreducible inguinal hernia, contained an incarcerated appendix with considerable fluid in the sac.

Tumors of the hernial sac, while found in both male and female, are much more common in the female, taking the form of a cyst, or the so-called hydrocele of the canal of Nuck.

Solid tumors of the inguinal canal are extremely rare. Kepler (*Boston Med. and Surg. Jour.,* Aug. 20, 1908) reports a case of dermoid cyst of the canal of Nuck and gives a very careful review of the literature. His case occurred in an unmarried woman, 26 years of age, who had worn a truss since childhood for a supposed right inguinal hernia. The hernia became apparently cured, but re-appeared two years prior to the date of the operation. The symptoms were strongly suggestive of catarrhal appendicitis with recurrent attacks. Examination showed a sausage-shaped painless swelling in the right inguinal canal which occasionally disappeared for a short time. This had been irreducible for about a year. Operation showed a mass occupying the canal of Nuck which could be displaced upwards about two inches. On opening the tumor there was an escape of much thick cheese matter with hair. Pathological examination was made by Dr. Leary of Tufts Medical College and showed it to be a cyst of the canal of Nuck. Microscopical examination proved it to be dermoid in character. Kepler's careful review of the literature showed this to be apparently a unique case.

I have seen one case of Fallopian tube in the sac of a femoral hernia. It was irreducible and very adherent. The patient was aged 29 years and the operation was performed February 4, 1909.

I have operated upon one case of multiple cyst of the canal of Nuck February 5, 1909. The patient was 41 years of age and had had a swelling of several years' duration in the right inguinal region; it had never been reducible. Operation disclosed four cysts of various sizes not communicating with one another, the uppermost one occupying the inguinal canal, separated from the abdominal cavity by a thin layer of peritoneum. The size and anatomical situation of the cysts are shown (Fig. 1).

Unusual Cases of Inguinal Hernia in the Female.—Inguinal hernia of tube and ovary, one case aged 12 years; one case aged 6 years; one case aged 3 years; one case aged 48 years. Strangulated hernia of appendix with large amount of exudate, one case, aged 35 years (Fig. 2). Double direct hernia with the bladder on the right side, one case, aged 55.

Interstitial Hernia (Case I).—*Strangulated interstitial hernia the size of a cocoanut, containing cæcum and ascending colon.* This case is so extremely rare, that it merits a detailed report.

Mrs. S., 40 years old, was admitted to the Hospital for Ruptured and Crippled in the afternoon of May 11, 1908, and operated upon immediately. She gave no history of ever having had a hernia, but three days before began to have pain and discomfort in the right lower abdomen, accompanied by almost complete obstipation, some nausea. The symptoms became gradually more severe. The nausea increased and was followed by slight vomiting. Before she was admitted to the hospital she had been examined by the house surgeon, who found a tumor in the right lower abdomen which was tender on pressure and irreducible. I saw her about an hour after admission; the pulse was 120, temperature 99.5°. While her general condition could not be called good, she did not show very marked prostration. She was fairly stout, with considerable adipose tissue in her abdominal wall.

Physical examination showed practically nothing abnormal on inspection. On palpation a tumor the size of a grape fruit or two fists could be made out in the right iliac region, extending up nearly to the level of the umbilicus and downward as far as the inguinal region. There was, however, no tumor either in the inguinal or femoral canals. On coughing, a protrusion could be felt apparently coming through the internal ring and extending partly into the inguinal canal. The whole tumor seemed to be situated beneath the external oblique aponeurosis; it was tympanitic on percussion, resilient on palpation, symmetrical in outline, and quite irreducible. I made a diagnosis of strangulated interstitial hernia, from the anatomical position of the tumor, and believed the contents of the hernial sac to be cæcum, for, had the small intestine been strangulated for such a length of time, the symptoms would have been much more acute.

A long, oblique incision was made over the tumor. On cutting through the skin and superficial fascia, I came down upon a greatly distended external oblique aponeurosis, which was then incised. It disclosed a very large hernial sac which lay on the outer side, beneath the external oblique aponeurosis and on the inner side was situated partly under the external and partly under the external and internal oblique both and the transversalis fascia beneath, making it practically a properitoneal hernia. This sac was found to contain several ounces of slightly cloudy exudate, the whole cæcum and part of the ascending colon which were dark-colored but with no areas of necrosis. Under hot towels circulation became sufficiently good to warrant their return into the abdomen. The patient made an uneventful recovery.

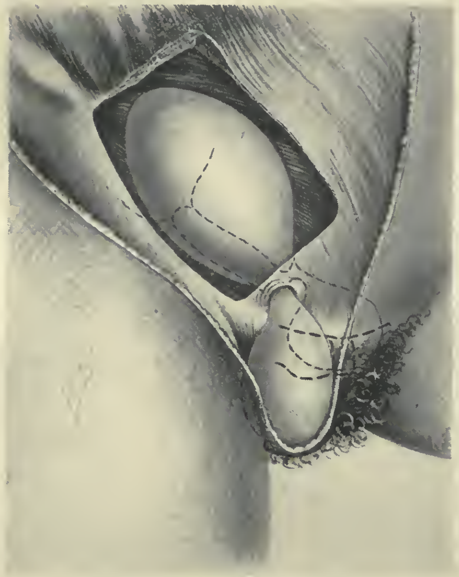
The strangulation was evidently caused by a strong fascial ring, apparently the internal ring and the intestine, after emerging from the internal ring, extended upwards instead of downwards until it had occupied the position already described (Figs. 3 and 5).

It seems to me the most probable explanation of the development of this hernia is, to regard the sac as a diverticulum of congenital origin.

There is another explanation which I formerly held to be the true one *i.e.,* to regard the sac as an acquired sac which had gradually taken the position found at operation because it had met with some obstruction in its downward course, and it simply followed the line of least resistance. This was the view held by Macready.

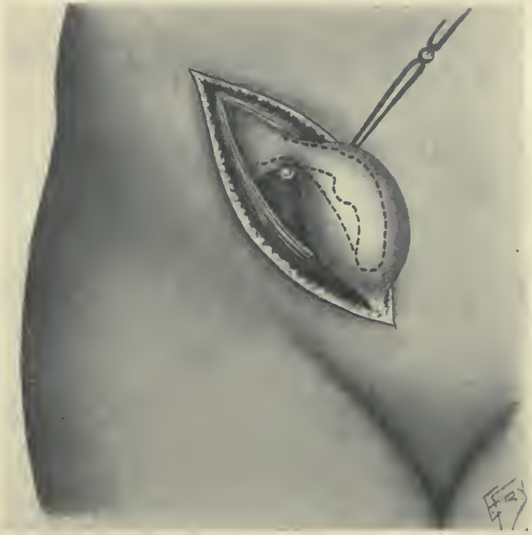
Interstitial Hernia in the Female is an extremely rare oc-

FIG. 1.



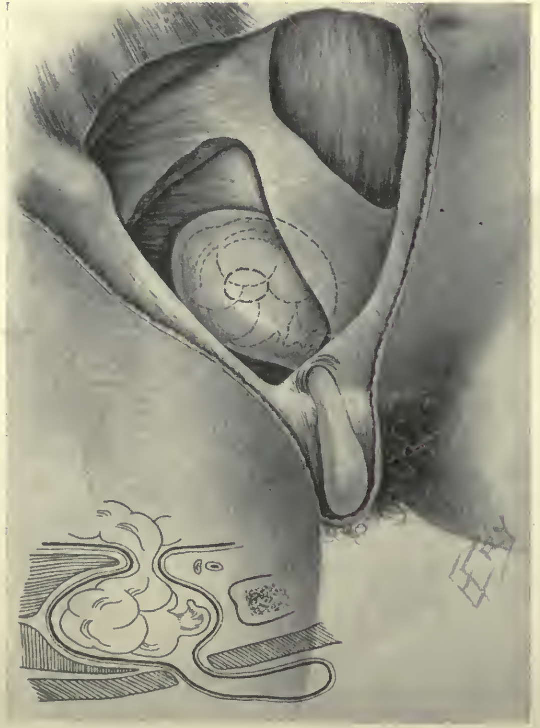
Multiple cysts of canal of Nuck.

FIG. 2.



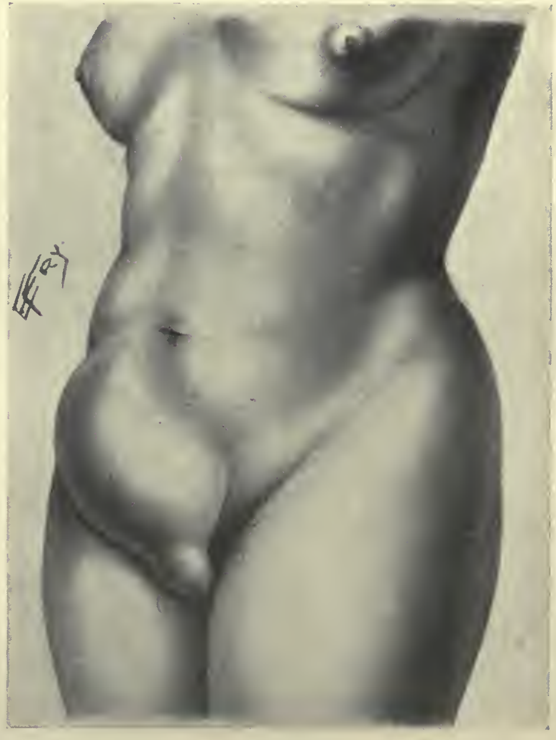
Incarcerated hernia of the appendix with sac distended with bloody fluid.

Fig. 3.



Strangulated interstitial hernia in the female.

Fig. 4.

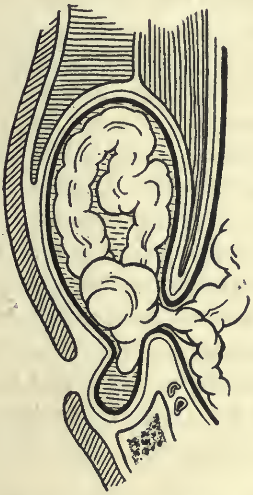


Interstitial hernia in the female, associated with hydrocele in the canal of Nuck. (Bull and Coley.)

currence and very few cases have thus far been reported. The first in this country was, I believe, the one reported by Dr. Bull and myself, in the *New York Medical Journal* in 1890. In this case the hernia was associated with a large hydrocele of the canal of Nuck which we at that time regarded as furnishing the mechanical obstruction which caused the hernial sac to proceed upwards beneath the aponeurosis of the external oblique (Fig. 4).

Case II.—*Properitoneal Hernia in the Female.*—A. M., aged 49, with a history of having had more or less discomfort in the right iliac region for a number of years; had never worn a truss. In the middle of February, 1909, she came to the Hospital for Ruptured and Crippled with a swelling about the size of a goose egg or small orange in right iliac and upper inguinal region. The swelling had appeared suddenly ten hours previous to her coming to the hospital, and was accompanied by a good deal of colicky pain, but no vomiting. The swelling was reduced by the house officer without an anæsthetic and the patient returned home. Two weeks later she was admitted to the Hospital for Ruptured and Crippled under the diagnosis of inguinal hernia, although one of the surgeons who saw her in the out-patient

Fig. 5.



Interstitial hernia in the female. (Coley.)

department regarded it as femoral hernia. The hernia was not down at the time of examination.

I operated upon the patient March 5, 1909, at the Hospital for Ruptured and Crippled. The usual Bassini incision was made over the inguinal canal; but on cutting down, I could find no enlargement of the external ring, in fact, I could hardly find an opening sufficiently large to introduce a director. This fact, together with the discovery of a mass of fat the size of an English walnut, in the femoral region, made me suspect an error in diagnosis and to think that we had really to deal with a femoral rather than an inguinal hernia. Careful dissection, however, of the mass of fat failed to disclose any sac whatever in the femoral canal. I thereupon opened the aponeurosis of the external oblique over the inguinal canal nearly to the level of the anterior superior spine and downwards through the external ring, which was not at all enlarged. Directly under the aponeurosis at the lower point, near the external ring, I found what proved to be a large hernial sac which extended upwards beneath the internal oblique muscle and the aponeurosis for a distance of at least 3 inches. On opening the sac it was found empty. The neck of the sac, about one inch in diameter, was situated at about the site of the normal internal ring. The anatomical situation of the sac between the internal oblique and transversalis fascia is well shown by the accompanying illustration (Fig. 6). The sac was removed, the opening in the peritoneum closed and the sheath of the rectus muscle was cut and reflected and, with the internal oblique, sutured to Poupart's ligament. The patient made an uninterrupted recovery.

The only other case of true properitoneal hernia in the female which I have been able to find in the literature in addition to the two cases in Göbell's collection, is the case reported by Sultan, in his paper on "The Mechanism of the Retrograde Incarceration of the Gut" (*Centralbl. f. Chir.*, Dec. 28, 1907), with three illustrations. In this case, however, no operation was performed. The condition was found at autopsy.

The patient, a woman 53 years of age, entered the hospital on September 19, 1907, with symptoms of perforative peritonitis. She was in a moribund condition at the time of entrance, so that it was impossible to operate. She died one and one-half hours later. Autopsy showed a hernia in the right iliac region between peritoneum and fascia, *i.e.,* an inguinoproperitoneal hernia. The sac contained two loops of small intestine and a mass of omentum. The hernial orifice lay in the internal inguinal ring, yet there was no constriction at this point. The strangulated loop of bowel was situated in the abdomen proper, showing the rare condition of retrograde incarceration.

Cumston (ANNALS OF SURGERY, 1905, p. 427) in a paper upon Interstitial Hernia, emphasizes the fact that the condition is extremely rare in the female. Of the 69 cases of inguinoproperitoneal hernia collected by Göbell only 2 were in the female.

Our knowledge of interstitial hernia is based chiefly upon the exhaustive paper of Göbell (*Deutsche Zeitschr. f. Chir.,* Bd. lvi). Of 115 cases collected by Göbell, only 4 occurred in women.

Cumston states that in the 11 cases collected by him up to 1900, not a single one was found in the female. He reports a personal case occurring in a girl of nine. Shortly before operation she had symptoms which were supposed to point toward appendicitis, which disappeared on confinement to bed. The symptoms were believed by Cumston to point toward a partial strangulation, which was relieved by horizontal position. The operation disclosed a bilocular sac, the lower end extending into the labium, the upper occupying a position between the internal and external oblique muscles.

Auvray (*Gazette,* June 10, 1901) reported a case of interstitial hernia in the female observed in 1900, and this case was believed by Cumston to be the first recorded case. He had, however, overlooked the case operated upon by Dr. Bull in 1890 and published in detail by Bull and Coley (Fig. 4).

Another case was operated upon by Helferich and reported the following year by Müller. Fredet reported a case in 1901; two others were reported in the same year by Brunco, in his thesis.

Intraparietal Hernia.—A most interesting case of interstitial hernia observed at Helferich's clinic was reported by Müller in his inaugural dissertation (1901).

The patient, who claimed to have never had a hernia, suddenly noticed a tumor in the inguinal region after lifting a child. One month later the hernia became irreducible and the patient entered the clinic. The diagnosis of interparietal hernia was made and immediate operation advised. The latter revealed half of the sac in the labium major, the other half between the external and internal oblique muscle, external to the inguinal canal. Isolation of the interparietal part of the sac was easily accomplished, while that of the portion in the labium major caused considerable difficulty.

Müller states that outside of the above, only 11 such cases have been observed—all males; 5 of these were reducible; 5 incarcerated; 1 was found at autopsy; and all 11 were crytorchids. Müller considers the case reported by him of special interest, as he believed it represented the first well-authenticated case of a hernia situated between the external and internal oblique in a woman, and also the first case that was irreducible. He had overlooked the case of Bull and Coley published ten years before. He states that the narrowness of the inguinal canal in the female and its greater length as compared to that in the male, account for the relative rarity of inguinal hernia in the female.

According to Jobert, the right inguinal canal in both sexes is wider than the left, which explains the greater frequency of inguinal hernia on the right side, at least in the female. Both of my cases occurred on the right side, as also did Dr. Bull's case.

Müller states that inguinal hernia of congenital origin is more frequently observed on the right than on the left side, and he believes that in the case reported the hernia was probably congenital, although the patient was not aware of its presence. For, only the pre-existence of a hernial sac, as shown by the investigations of Roser, Linhart and English, renders the sudden appearance of a hernia possible. This is also my opinion, and the conditions found in both of my cases strongly confirm this view. In one case the lower loculus of the sac passed beyond an external ring too small to permit the passage of hernial contents.

The first exhaustive description of an interstitial hernia was published by Goyrand in 1836. Göbell, in his work "On Interparietal Inguinal Hernia" (*Deutsche Zeitschr. f. Chir.*, lvi Bd.) gave a critical review of the literature of the subject and suggested a nomenclature which, Müller thinks, well worthy of general adoption. He distinguished complete and incomplete hernia, subdividing these into:

1. Inguinoproperitoneal hernia.
2. Inguinointerstitial hernia.
3. Inguinosuperficial hernia.

These might be further divided into monocular and bilocular interparietal herniæ.

The monocular herniæ are usually congenital, while the bilocular may be either congenital or acquired.

The principal etiological factors in the development of these herniæ Müller believes to be (1) The anatomical structure of the canal; (2) An impediment (either mechanical or anatomical) to the passage of the hernial contents.

Inguinoproperitoneal hernia had been observed 69 times up to the writing of Müller's dissertation; 67 times in men and only twice in women. Only 7 were reducible; the remainder showed symptoms of incarceration, and in the majority of cases the hernia was not discovered until the time of operation.

The hernia was found on the right side in 37 cases; on the left, in 23; in 9 the side was not stated. Sixty of these herniæ were bilocular.

Of inguinointerstitial hernia, Müller found 200 cases reported. Of these 162 occurred in men, 38 in women. 129 and 34 of these respectively, are included in Macready's statistics of reducible herniæ. They were not operated upon nor was autopsy performed; hence, all anatomical data are absent. In the remaining cases the histories are sufficiently explicit to enable one to determine in which interstices of the muscles the sac was found. Most frequently it was noticed between the external and internal oblique, and of this variety, as has been stated before, only 12 cases (including Müller's) are known. My own case makes 13.

The rarest cases of inguino-interstitial hernia are those in which the sac is embedded between the fibres of the internal oblique muscle, or between internal oblique and transversalis fascia. My second case was of this variety.

Moynihan even claims that such herniæ have never been seen. It must be stated, however, that Goyrand, Berger and Venturoli have seen fibres of the internal oblique muscle anteriorly and posteriorly to the sac, in fact, Goyrand considers this a characteristic of this variety of hernia; in Berger's case the hernial sac was found within the thickness of the internal oblique, and Venturoli was obliged to sever the fibres of the internal oblique in order to reach the sac.

As interparietal herniæ are very apt to become incarcerated, radical operation is the best treatment.

Brunco (Inaugural Dissertation, 1904) reports two cases of left interstitial hernia in the female, operated upon by Graser of Erlangen.

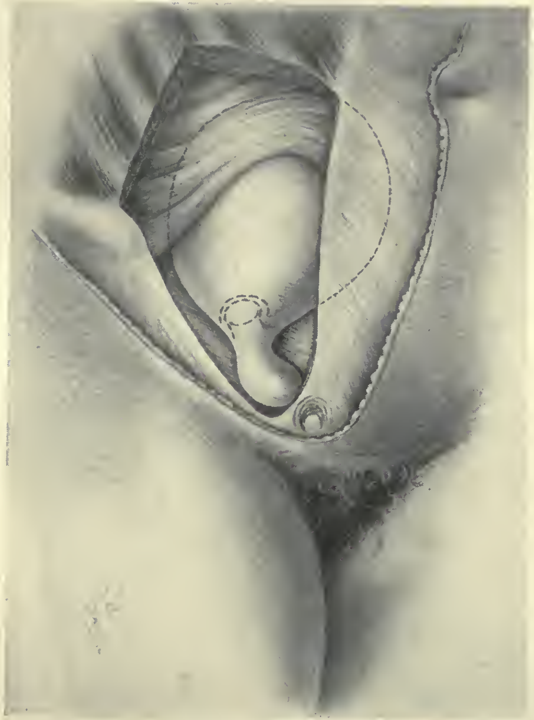
Case I.—A widow, 66 years of age, with a history of a small lump in inguinal region for three years, with rapid increase in size in last year. The hernia was found between the external and internal oblique muscles.

Case II.—A woman, 46 years of age, with a history of severe attacks of vomiting during the past sixteen years, recurring at intervals of a few weeks to three months. Medical treatment was employed without relief. In the left groin a protrusion the size of the fist was found, extending from the external ring upwards towards the anterior spine of the ilium. On splitting the aponeurosis a hernial sac was found lying between the external and internal oblique muscle and containing a loop of inflated small intestine.

Brunco states that radical operation should be performed in all cases of interstitial hernia, since the prognosis in the cases not operated upon is unfavorable, far more so than in ordinary inguinal hernia, for the reason that they are very apt to become incarcerated. One half of Göbell's cases were incarcerated.

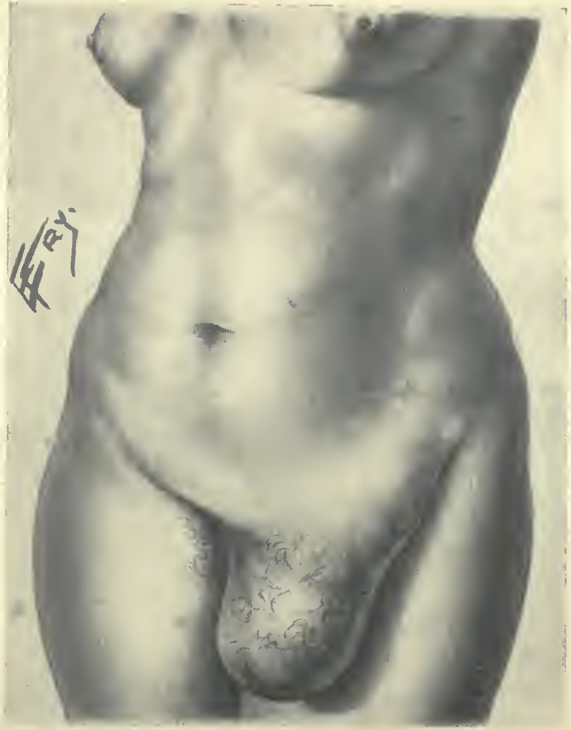
Method of Treatment of Inguinal Hernia in the Female.—In a considerable number of cases of hernia in the female in infancy and early childhood, the hernia is either cured by the wearing of a truss, or, in some cases, even spontaneously.

FIG. 6.



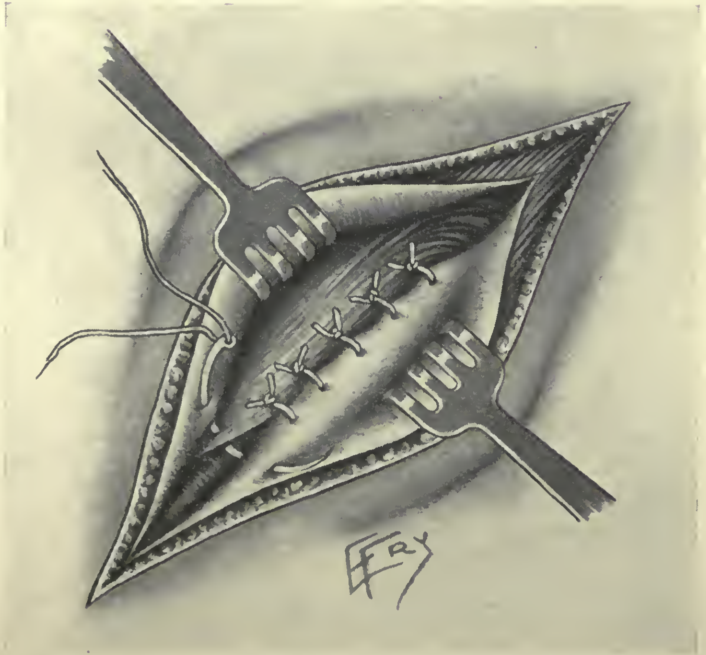
Properitoneal hernia (inguinal) in the female.

FIG. 7.



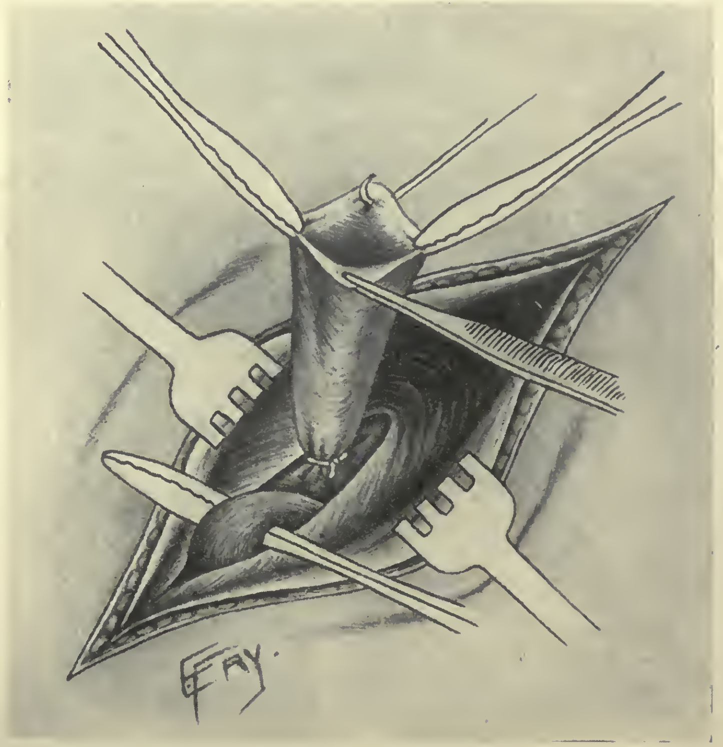
Labial hernia.

Fig. 8.



Modified Bassini method. Suture of the internal oblique to Poupart's ligament without transplanting cord. Note last stitch placed to include reflected aponeurosis. (Bull and Coley.)

Fig. 9.



Inguinal hernia in female, showing sac dissected from round ligament.

For this reason, I do not go so far as Stiles and Carmichael of Edinburgh and some of the French surgeons, notably Broca, in advising operation during this period of early infancy. The statement which I have already referred to, that our statistics at the Hospital for Ruptured and Crippled show 6 per cent. of adult cases of inguinal hernia in the female in which the hernia existed during infancy and childhood, although short of the actual truth, still show that a large number of the cases that occur in early life, are cured without operation, for we know that inguinal hernia in the female is far more frequent during infancy than at any other period of life. Personally, I seldom advise operation in children under the age of three to four years; first, because I prefer to give the child the chance of a mechanical cure, and, second, because there is little risk from strangulation at this age. I have never seen a case of strangulation in inguinal hernia in the female under the age of fourteen. In addition, should strangulation occur, the mortality of operation is very small. In 20 cases of strangulated hernia in children at the Hospital for Ruptured and Crippled, we have not had a single death. After the age of three to four years, we believe it wise to operate on practically all cases. The operation is simple, free from risk, and the child need not be confined to the bed more than 10 days or two weeks. Adults I usually keep in bed for two weeks and allow them to go home at the end of two and a half weeks.

Method of Operation.—The method of operation which I have employed has been the same in the entire series of cases, and consists in an operation practically identical with the modified Bassini operation which Dr. Bull and myself introduced at the Hospital for Ruptured and Crippled in 1892. (See ANNALS OF SURGERY, 1895, '97 and '98.) The only variation from the typical Bassini operation is that the cord is not transplanted, but allowed to emerge at the lower angle of the wound. In the female the round ligament is treated the same way as the cord in the male, in that it is left undisturbed at the bottom of the wound, the internal oblique being sutured to Poupart's ligament; the aponeurosis is then closed and last of all, the skin as shown in Figures 8 and 9.

The transplantation of the round ligament as proposed and carried out by Howard Kelly ("Operative Gynæcology") at Johns Hopkins, is entirely unnecessary and has not given as good results as when it has been allowed to remain undisturbed.

Some surgeons, among them Championniere, have removed the round ligament along with the sac, for the reason that the dissection of the sac from the ligament is much more difficult than the dissection of the sac from the cord in the male.

However, with a little care, and going about the dissection in the right way, one can always separate the sac from the round ligament, and I have always done this, believing it unwise to unnecessarily sacrifice the ligament. The sac is then dissected high up beyond the neck and closed by transfixion with a catgut ligature, the wound being then closed in the way I have described in the modified Bassini operation (the Bassini method without the transplantation of the cord.

Results.—In this series of 353 cases, there has been no death and but two relapses, and the large majority of cases have been traced to final result. One of the relapses occurred in a woman 35 years old, two years after operation, and was brought on by very heavy lifting which, at the same time, caused a hernia on the sound side. The second relapse was anticipated, for the reason that the operation was performed in a woman seven months pregnant, 35 years of age, with a very large strangulated inguinal hernia the size of two fists. The sac and outlying tissues, including fascia and muscles, were infiltrated with exudate and the gut was in a precarious condition. The operation was performed as rapidly as possible and the wound closed with drainage. Extensive suppuration followed, and although the patient was delivered at full term of a healthy child, the wound had not become firm enough to stand the severe strain of childbirth, and relapse occurred shortly afterward.

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SURGICAL ASPECTS OF CHRONIC HYPERTROPHIC ARTHRITIS.

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THE study of chronic disease of the joints has become enhanced in interest in recent years by the special attention given to those forms generally called rheumatoid arthritis or arthritis deformans. A perusal of the recent literature gives one the impression that the study of this disease is of comparatively recent date and that heretofore all chronic joint disease, not of distinctly infectious origin, was generally classed under the heading of chronic rheumatism. But although the use of the X-ray has made many of the symptoms and signs of the bony lesions more easily comprehended we have made but little advance in the study of the etiology of the affection nor have we learned to check the deformities with certainty. We have simply supplied new names for old conditions and the writings of Charcot, Garrod, Heberden, etc., are nearly as accurate as more recent and therefore better known writers.

The great variety of the lesions, the lack of unifomity in the symptoms, and especially the uncertainty of the etiologic factors are responsible for the existing confusion in nomenclature, there being almost as many classifications as there are monographs on the subject. Broadly, chronic joint disease can be divided into those of infectious origin and those which are supposedly non-infectious; the latter embrace those caused by a distinct trauma, by some dyscrasia such as hæmophilia, by some purely functional cause, and those types associated with anatomic change and deformity.

A deforming arthritis may arise as an apparent primary affection, may be secondary (reactive) to disturbed nutrition

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* Read before the Philadelphia Academy of Surgery, May 3, 1909.

of the joint, or may be neuropathic, as in tabes or syringomyelia. By a process of exclusion we may arrive at a classification embracing a variety of chronic joint affections which at first seems all sufficient to comprise the clinical material. Actually, in a given series of cases, we may see similar lesions and symptoms due in one patient to a trauma, in another to a well-established previous attack of acute articular rheumatism, in a third to some metabolic disorder, and in a fourth without discoverable cause. An attempt was made a few years ago in England to study rheumatoid arthritis by means of a small hospital where patients could be received for a short time and studied. Bulletins were issued under the leadership of Dr. T. S. P. Strangeways and valuable information gained, but the work was discontinued for lack of funds.

Hypertrophic arthritis, sometimes called osteo-arthritis, is that form of chronic joint disease characterized by a hypertrophy of the cartilage and bone and the formation of osseous spurs at the margins of the articular cartilages or at the attachments of the ligaments. Males of about 45 years of age are most liable to be attacked, and cold, exposure, strains, and various forms of trauma are considered as factors in the etiology. Rimann in a recent paper found 25 knee-joints affected in 100 post-mortem subjects, the disease being in various stages, and in 17 the cause of death was arteriosclerosis in some of its manifestations, in 4 tuberculosis, and in 4 carcinoma. As to the exact cause nothing but speculation has so far been indulged in, the most generally accepted theory being that an autoinfection from defective metabolism causes a fibrous metaplasia of the cartilage, capsule, and ligaments, a thickening from osteosclerosis of the ends of the bones and a proliferation of the bony tissue from the diseased cartilage which is not subjected to pressure.

The cartilage and bone seem to bear the brunt of the disease, as the synovial membrane is not much thickened; there is little villous hypertrophy nor is there much fluid present unless there has been a recent sprain. The cartilage is thickened, glistening, and dense in appearance and at its margin, *i.e.,* at the junction with the synovial membrane, is congested, often bluish and elevated into ridges and nodules. The latter are most apt to occur at the lateral margins of the knee-joint, along the epiphyseal line and superior lip of the acetabulum in the hip and extending into the lateral ligaments of the fingers, in which case the term Heberden's nodes is often used. If erosion of the cartilage occurs it takes place at points where pressure is brought to bear and is of the nature of decubitus erosions. Detached pieces of cartilage are but rarely observed. The bone is thickened and the cartilaginous masses referred to become ossified and form the characteristic spurs. If erosion of the cartilage takes place the bone may become eburnated, with a polished surface and usually white in appearance, although discoloration with blood pigment may give a reddish color. Ankylosis does not appear to supervene, as a rule, probably from the lack of deposited fibrin. Microscopically the cartilage is thickened and fibrous, the bony trabeculæ are large and thick but there is no evidence of endarteritis nor of a cellular infiltration. Without digressing further I wish to present the following case observed on the service of Dr. C. H. Frazier in the Hospital of the University of Pennsylvania and to whom I am indebted for the privilege of operating upon the patient:

C. W. B. (No. 914); age 69; male. Was first admitted to the University Hospital March 29, 1905, with the following history: Has always been exposed to cold and wet, first as a seaman and later as a locomotive engineer. Had several attacks of gonorrhœa and twenty-five years ago contracted syphilis. Five years ago (August 10, 1900) an enlarged bursa was removed by Dr. Frazier from his right popliteal space and he dates the present trouble from about the same time, although not to the effects of the operation nor to the bursa itself. He suffered from severe pain in the knee when the right leg was extended which, radiating up the thigh, was increased by use. The leg never became locked in flexion or extension. It was believed that he was suffering from some hypertrophy of the synovial membrane with "pinching" of the fringes. On March 30, 1905, Dr. Frazier explored the joint and found the lipping characteristic of a hypertrophic arthritis without displacement of the semilunar cartilages. He was discharged April 12, 1905, with the instruction to rest the knee as much as possible and to wear an elastic support. He returned several times during the next three years but was merely examined and various forms of local applications prescribed, including the use of the baking apparatus. He was able to work as an engineer until September, 1907, without much pain or serious inconvenience, although he noted that the joint was increasing in size. From this time on the knee began to pain considerably and he was forced to give up working, but could get around with the aid of a cane. He returned to the University Hospital April 11, 1908, and was anxious to have an amputation done if the pain could not be otherwise relieved. The right knee was visibly enlarged but was not very tender nor were there any signs of effusion, the hypertrophy to the touch and to the X-ray being due to bony overgrowth. His joints were generally prominent and some of the metatarsophalangeal joints were also the seat of bony hypertrophy, but they caused no annoyance. The feet were flat and the legs showed varicose veins. He had no prostatic, cardiac, or renal troubles. On April 13, 1908, I opened the joint by a transverse elliptical incision below the patella which disclosed the typical appearance of the disease. The bony outgrowths not only involved the edges of the joint but extended upwards on the anterior surface of the femur for 2 inches. The posterior surface of the patella was similarly involved. The semilunar cartilages were small and narrow, the synovia thickened and slightly congested, there was merely a glairy fluid in the joint, and the internal articulating surfaces showed sufficient erosion of the cartilage to bare the bone. It was thus seen that the creaking and pain were evidently produced by the grinding of the bared bony surfaces and the enlargement and thickening were due to the bony outgrowths. Removal of the latter did not seem to offer any prospect of relief from pain and accordingly I performed a formal excision of the knee-joint. As an arthroplasty was also not deemed advisable the femur was sawed so that its diameter would approximate that of the tibia and allow of fixation in a slightly flexed position. The exostoses were chiselled from the shaft of the femur and from the under surface of the patella. The lateral ligaments were sutured and the patella drilled and fastened over the line of excision by catgut sutures. The skin was closed without drainage and the limb placed on a posterior splint. Healing by first intention resulted and a week after operation a plaster-of-Paris cast was applied. The patient was discharged June 10, 1908, on crutches with apparent bony union. He returned, however, on July 28, 1908, with pain in the knee and a slight degree of motion, the pain being sufficient to prevent him from working. An X-ray picture showed a distinct line between the ends of the bones and after a week in bed I again operated (August 8, 1908) upon the limb. After dividing the hamstring tendons, a transverse incision was made over the line of excision and the bones pried apart with a chisel. The ends were well curetted and a groove chiselled on either side of the femur one inch above the line of union and from which the bones were fastened together by two silvered steel screws two inches long. The grooves had the effect of countersinking the heads of the screws and enabled them to be driven almost downwards. The wound was again closed without drainage and the leg placed immediately in a cast. It once more healed perfectly and on October 22, 1908, the patient was discharged with bony union, the leg being protected by a light steel brace at the knee owing to the spring of the long lever from hip to ankle. I heard from him in December and he was walking on the limb with but little disability and no pain.*

The treatment of the various manifestations of hypertrophic arthritis will seldom be surgical. Pain, swelling, stiffness, and deformity are the symptoms calling for relief, and an earnest attempt should be made to determine the etiology of the case. Any form of chronic infection, whether from the tonsil, intestine, prostate, etc., must be eradicated, the diet carefully regulated, general massage ordered, and rest of the limb enjoined, preferably by extension if the hip or knee is involved or affected. In hypertrophic arthritis it is obvious that incision and drainage of infected fluid is never indicated, as the disease has never been shown to be due to the presence of bacteria in the joint, nor is there any effusion. The swelling is essentially due to thickening of the bones and the presence of bony outgrowths upon the tibia and femur at the edge of their articular cartilages and which in most cases does not require operative interference. The performance of excision as a primary operation is not generally countenanced although in Germany a number of surgeons have performed this operation in the hope of arresting the disease in other joints. But it is probable that they have confused the acute stage of hypertrophic arthritis with an infectious polyarthritis in which disease prompt operative interference must soon be considered as the treatment of choice.

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* After reporting this case to the Academy of Surgery I saw this patient in June, 1909. He had discarded his brace, had been drinking heavily and was in wretched physical condition. The knee pained him considerably at the site of the screws. I advised their removal but he has not returned.

Pain due to the grinding together of the swollen and eroded cartilages can usually be relieved by rest and extension. When the acute stage has passed, active hyperæmia tends to prevent recurrence of pain, but occasionally, as in the case reported, every attempt made by the patient to resume his occupation is followed by a recurrence. This is especially true in the knee- and hip-joints, and for such cases I would urge the performance of excision, provided that a careful trial of other methods has been practised.

Stiffness or limitation of motion is due to the presence of thickened bone and of the bony outgrowths from the margins of the cartilages, and while the latter can be removed to some extent it will be apparent that in most cases such an operation would have to be very extensive to effect complete removal. When the hip is involved Goldthwait advises the removal of the entire head of the femur in preference to an attempt to remove the individual nodes, and recently Albee has reported 5 cases of partial excision of the articulating surfaces of the femur and acetabulum by a new method, with relief of the pain in every case and the ability to walk without crutches. Sometimes the spurs project into the joint and produce a hypertrophy of the synovial membrane. In occasional instances they may become detached and form loose bodies in the joint, in which case arthrotomy may be necessary.

Deformity is best treated by prevention during the acute stage which if properly managed will be found on subsidence to have resulted in but little change in the relation of the bones. If ankylosis in bad position does occur, especially in the knee or hip, osteotomy must be considered.

TRANSACTIONS
OF THE
NEW YORK SURGICAL SOCIETY.

Stated Meeting held April 28, 1909.

The President, Dr. Joseph A. Blake, in the Chair.

PNEUMOCOCCUS PERITONITIS.

Dr. George Woolsey presented a girl, 7 years of age, who was taken sick on January 23, 1909, with sore throat, cough, fever, abdominal pain, anorexia and diarrhœa. Five days later she had a sudden sharp pain in the entire lower abdomen, and vomited repeatedly. On the following day the vomiting ceased, but the pain and tenderness persisted.

On admission to the hospital, on January 30, the abdomen was somewhat distended and symmetrical. The respiratory movements were very restricted. The abdomen was rigid and tender everywhere, especially in the right lower quadrant, and there was a sensation of a mass under McBurney's point. The abdomen was tympanitic except over this mass and in both flanks, where there was shifting dulness to the level of the anterior superior spines. An examination of the lungs showed exaggerated breath sounds over both upper lobes anteriorly, and dulness and diminished breath sounds at the right base and over the outer part of the right scapula. The patient's temperature on admission was 104; pulse, 160; respirations, 56. A blood count showed 67,000 leucocytes, with 94 per cent. polymorphonuclears. The blood pressure was 85.

Operation, January 30: Through a muscle-splitting incision the appendix was found in the retrocolic region; it was removed and was apparently normal. The abdominal cavity was filled with pus, watery above, with a few flakes, and thicker and yellow in the pelvis. As no perforation was found after thorough search in this region, a second median incision was made in the epigastrium, and the stomach, gall-bladder and duodenum examined; but no perforation was found. There was but little pus above the level. The upper wound was thereupon sutured, and the lower wound closed with a drain to the pelvis. The patient was in fair condition after the operation. She was put to bed in the Fowler position, and continuous enteroclysis given. Her pulmonary condition developed in the next few days into a double lobar pneumonia, and on account of a persistent cough she was placed in a tent with a croup kettle. There was slight distention of the abdomen at first, but after an initial enema the bowels moved freely. The patient's condition was precarious at times, but on the whole she became slightly better. An examination of the pus evacuated from the abdomen showed a pure culture of pneumococcus.

February 6: The patient's temperature at this time was 100.2; respirations and dyspnœa slightly improved; pulse, 140. The enteroclysis and Fowler's position were discontinued. The pulmonary symptoms improved somewhat, and the patient became more rational. There was a slight, shreddy purulent discharge from the lower wound.

During the following week the patient was somewhat better one day, worse the next, and on February 11 the croup kettle was discontinued and she was moved to the roof of the hospital in the open air. Three injections of 10 c.c. of His' serum were given, one on the sixth and two on the eleventh. Her cough had been so severe that the stitches in the upper wound had been torn out. From the time of her removal to the roof, and whether attributable to that or to the use of the serum, she made a gradual but steady improvement. On March 17 the patient suddenly began to vomit, and upon examination of the abdomen an induration was found below the appendix wound. This was broken into by a pair of forceps, and about a pint of foul pus was evacuated. Her further convalescence was uninterrupted, and she left the hospital, cured, on April 10, 1909. She will require subsequent operation for the ventral hernia.

Dr. Woolsey said that very little appeared on the subject of pneumococcus peritonitis in the text-books. In an article by Musser in Osler's System the statistics given showed a very high mortality. Since operating on the above case the speaker said he had seen a second case of pneumococcus peritonitis in a woman, with a history dating back five days, who was brought to the hospital in a moribund condition and who died within a few hours without operation. At the autopsy, nothing was found excepting free pus in the abdominal cavity which upon examination showed a pure culture of the pneumococcus. The abdominal, pelvic and thoracic viscera were normal.

STRANGULATED INTERSTITIAL HERNIA IN THE FEMALE. PROPERITONEAL HERNIA IN THE FEMALE.

Dr. William B. Coley presented these two cases, which are described in full in his paper on Inguinal Hernia in the Female, for which see page 609.

DOUBLE INGUINOPERINEAL HERNIÆ, WITH DOUBLE ECTOPIA TESTES.

Dr. Coley presented a boy of 12 years, who was operated upon at the Hospital for Ruptured and Crippled in March, 1909. On the right side there was found a bilocular hernial sac, the upper loculus being of the inguinosuperficial variety and extending over the aponeurosis of the external oblique half way to the anterior superior spine. The lower loculus extended into the middle of the perineum. The testicle itself was found within the internal ring.

On the left side the sac was monolocular, extending into the perineum nearly to the anus. The testicle was found in the midperineum. The scrotum was entirely empty. The sac was closed on both sides high up beyond the internal ring, precisely as in Bassini's operation for hernia. The lower end of the sac was removed from the perineum, carefully sutured over the testicle, and the testicles then placed in the new pouches made by digital dilatation in the bottom of the scrotum. The cord was not transplanted on either side, and was of sufficient length to allow the testicle to rest in the bottom of the scrotum without tension. The patient made a perfect recovery and left the hospital at the end of two and one-half weeks. The testicles at present were in the bottom of the scrotum, and of normal size.

Dr. Coley stated that he had operated upon 11 cases of inguinoperineal hernia with perineal ectopia, but this was the only case he had seen in which the condition was double. While formerly he believed that in many cases this condition was acquired, he no longer held this view, and now regarded all such sacs as of congenital origin. This case furnished almost positive proof of the congenital origin of the sac, inasmuch as on the right side, while the sac extended into the perineum, the testicle itself was in the abdomen.

THE RESULT OF BIER'S TREATMENT OF TUBERCULOSIS OF THE TARSUS.

Dr. Willy Meyer presented a girl, 30 months old, who had tuberculosis of the tarsal bones of both feet, several of the bones being the seat of tubercular foci. An attempt was first made to extirpate part of the bones, but the disease was so far advanced that this was abandoned for conservative reasons, and Bier's treatment was instituted. Every day the elastic bandage was applied for eleven hours out of every twelve, according to Bier's method, and in addition to this, suction was applied by means of a large glass for 45 minutes, such as was usually employed in the treatment of mastitis, but here adapted to the child's foot with the help of a rubber cuff. After a time, the child was taught to apply the proper amount of suction herself, by working the suction pumps. In this way her timidity was overcome. Gradually, the discharge ceased, and when the patient left the hospital, on August 1, 1908, the sinuses in both feet had entirely closed. She was now able to go about and was practically well. The mother had been instructed to continue the use of the elastic bandage during the night and have braces made to overcome the tendency to the development of flat-foot.

URETEROPLASTY FOR INTERMITTENT HYDRONEPHROSIS.

Dr. Meyer presented a girl, 18 years old, who three years ago began to complain of attacks of pain, intermittent in character, in the left lumbar region. These attacks usually lasted for ten or twelve days. At first they recurred every three or four months, and then with increasing frequency and severity until finally the patient became absolutely disabled.

Upon examination, Dr. Meyer found a large tumor in the left lumbar region which was apparently connected with the kidney, and which spontaneously disappeared simultaneously with the pain, in the course of a few days.

Operation: After resection of the twelfth rib through a posterior longitudinal incision, he came down upon an œdematous hydronephrotic sac, only partially filled. The ureter was angled. It was decided to make an attempt to save the kidney. A ureteroplasty was thereupon done, adapting the Finney method to the distended renal pelvis and upper portion of the ureter. On account of the thinness of the sac only one line of continuous suture could be made. Catgut was used.

There was first some leakage from the wound after the operation, but the patient made a good recovery, and soon began to pass urine in large quantity. She had been free from attacks since the operation and was now apparently enjoying excellent health.

CRANIOTOMY FOR TUMOR OF THE BRAIN: DECOMPRESSION OPERATION.

Dr. Meyer presented a man, 47 years old, who was admitted to the German Hospital in February, 1909. His family and previous histories were negative; venereal disease was denied, and his habits were good.

About seven weeks prior to his admission he began to complain of attacks of pain, neuralgic in character, affecting the right side of the head, the corresponding side of the face above the jaw, and the right teeth. These attacks were of gradual onset, occurring as frequently as every two hours, and were of increasing intensity. His eyesight had been failing for ten months.

Examination showed that this area of neuralgic pain corresponded with the distribution of the first and second divisions of the trigeminal nerve. There was weakness of the muscles of the right face and atrophy and weakness of the right masseter and pterygoid. There was increasing optic neuritis of both eyes, particularly the right, with slight nystagmus affecting both eyes. There was analgesia of the face, gums, roof of mouth and cornea of the right side. The gait at times was staggering in character, with deviation always to the right side. The right masseter muscle showed increased galvanic and faradic excitability. While in the hospital, the patient had several epileptoid attacks, consisting of (*a*) complete loss of consciousness; (*b*) deviation of the right eye to the left; (*c*) after these attacks, a paresis of the right abducens.

A tentative diagnosis of tumor of the brain, located probably in the region of the right Gasserian ganglion, was made, and on March 11, 1909, an exploratory craniotomy and decompression operation was done. The important points of this were: (1) The formation of a temporal osteoplastic flap, with its pedicle anterior to the ear. (2) Elevation of the petrosal periosteum, exposing an apparently normal Gasserian ganglion. (3) Ligation of the right middle meningeal artery. (4) Removal of bone for decompression. (5) Removal of subjacent dura mater. (6) Remarkable thinness of squamous portion of temporal bone was noted. (7) Before incision of the dura, the brain appeared to be under considerable tension. (8) Brain surface did not appear resistant at any place to the palpating finger, also not at the base.

On the seventh day after the operation the flap was noticed to bulge slightly. There was involuntary defecation, and paresis of the left side of the face became apparent. The bulging of the flap gradually became more marked. On the thirteenth day there was paralysis of the left arm and leg; the patient was in a state of coma, and his condition was becoming serious. Puncture of the brain through the flap brought no fluid. Lumbar puncture was then done, and 40 c.c. of clear, straw-colored fluid was withdrawn. Light pressure on the skull flap caused an increase in the speed of the flow, and when the patient left the table the flap was already soft. Two hours later it was slightly scaphoid. On the fifteenth day the wound was again under such tension that a second lumbar puncture seemed necessary. But a few hours later a deep hollow again appeared, where shortly before the flap had been bulging. On the seventeenth day the patient could move the affected arm and leg and was able to answer questions intelligently. Since then his condition had gradually improved. The frequent change in tension of the flap continued for several weeks. According to experiments with various drugs it appeared that the changes were not due to changes in blood pressure, but rather to such in cerebral circulation. The patient had at present only slight weakness in the left arm and leg, with a paresis of the left side of the face and throat. He complained of persistent headache in the region of the vertex. The optic atrophy was increasing, especially in the right eye.

EMPYEMA: IMMEDIATE DISTENTION OF THE LUNG WITH THE HELP OF THE NEW POSITIVE DIFFERENTIAL PRESSURE APPARATUS.

Dr. Meyer presented a boy, 4½ years old, who, when he entered the hospital four weeks ago, gave a history of pneumonia of both left lobes followed by a purulent collection in the left pleural cavity. A resection of the rib was made in the usual way; and the pus given proper exit. The masses of fibrous coagulation were thoroughly removed. Then the boy's head was placed in the positive differential chamber, and under a pressure up to 14 mm. There was immediate expansion of the inflamed lung. Still, it could not be distended sufficiently to bring the visceral pleura in contact with the costal, however. The wound was not drained. A very extensive dressing was then applied, differential pressure being continued, with the idea of preventing the access of air. Immediately following this operation the boy's temperature dropped, and his breathing was improved. First change of dressing six days later, with positive pressure. Lung seen in front of wound of better (pinkish) color; slight discharge from wound. After another week the boy had a sudden rise of temperature. His head was again put into the compressed air apparatus, and upon removing the dressing it was found that the wound had become closed by granulations. Upon gradually increasing the pressure, these granulations gave way, and there was a tremendous gush of seropus from the wound. A gauze drain was thereupon inserted. Following this, the patient's temperature again dropped. After six days there was another slight rise. He was again placed under the influence of compressed air and a small cigarette drain was inserted, which he still retained. At the present time he was placed in the differential chamber every day, and made to breathe under the increased air pressure. With the aid of such an apparatus, Dr. Meyer said, he thought our method of the after-treatment of empyema would be simplified, especially in adults, in whom it usually took so many weeks to bring the empyema cavity to a definite close. The effect of the differential air pressure apparatus will naturally be of greater effect when resolution of the lung tissue has been completed after cessation of the pneumonic symptoms. It stands to reason, that the inflamed lung with its reduced elasticity cannot be easily distended.

EXPLORATORY THORACOTOMY, UNDER POSITIVE PRESSURE, FOR ŒSOPHAGEAL CANCER.

Dr. Meyer presented a man, 37 years old, who first experienced difficulty in swallowing about seven months ago, due to the presence of a cancerous growth of the œsophagus. The dysphagia gradually increased, and as it was impossible to dilate the stricture from above, it was planned to make an effort to reach the diseased portion of the œsophagus through an intercostal incision, then draw part of the stomach upwards into the thorax, and after resection perform œsophagogastrostomy. Careful measurements, made prior to the operation, had shown that the œsophageal obstruction was apparently located about six centimeters above the cardia. On April 17 the incision was therefore made in the eighth left intercostal space and the ribs drawn apart by means of Mikulicz's rib spreader. At this point a number of old pleuritic adhesions were encountered, fixating the lower lobe of the lung to diaphragm and chest wall; these were gently loosened. Upon finally reaching the œsophagus, the cancerous growth was found to be located at a higher level, embracing at least five to eight centimeters of the œsophageal tube. It was inaccessible from the exploratory thoracotomy wound. The wound was thereupon closed, as it seemed unwise to tax the reduced patient's strength too much. At a subsequent time, perhaps, Dr. Meyer said, he would undertake a second operation on the patient, making the incision higher up on the thorax. He would then attempt to excise the tumor and close both ends of the œsophagus. A gastric fistula had, of course, to be established for permanent feeding.

MULTIPLE SYMMETRICAL LIPOMATOSIS.

Dr. Otto G. T. Kiliani presented a man, 48 years old, with multiple symmetrical lipomata involving the face, neck, chest, and abdomen. He stated that these tumors, some of which were of mammoth size, so that they constituted a real deformity, began to develop about six years ago. He was first operated on by Dr. Kiliani on June 30, 1906, when three of the growths were removed, one in each parotid region and one underneath the lower jaw, overhanging the chest. He made a prompt recovery from the operation, and there had been no recurrence of the growths at the site of the removals.

Since then a large lipoma had appeared on the back of the neck, and there were numerous others involving the cheeks, mammæ, deltoid region and back. Some of these growths had remained unchanged for a number of years, and one large lipoma of the abdomen had disappeared spontaneously. They had never given rise to any pain or other symptom. Dr. Kiliani said his intention was to remove those which were unsightly, as they interfered with the man's occupation, which was that of a bartender. (See Figs. 1, 2 and 3.)

THORACOPLASTY.

Dr. Kiliani presented a man, 38 years old, who was first operated on in Hamburg about two and a half years ago for empyema, a rib resection being done. He was first admitted to the German Hospital on August 4, 1908, with the following history: About four years ago he had pneumonia, followed in the course of two months by empyema, necessitating a resection. This wound healed, but reopened spontaneously three months later, and after discharging pus for several months it again closed. Since then it had reopened and closed several times. He complained of a dry cough, without expectoration. He had occasional night sweats and had lost some weight.

Examination of the chest at that time showed a cavity which extended upward and forward to a depth of seven and a half inches. No bare bone could be felt. Percussion over the entire right chest wall was flat, with increased fremitus and voice and breathing sounds.

Operation, August 10, 1908, by Dr. Stetten: An incision was made through the old scar and the eighth rib was resected. The sinus which passed through this rib led to a cavity from which about a quart of pus was evacuated. The cavity was packed with iodoform gauze. The patient left the hospital on October 19, 1908, improved, and was referred to the dispensary for further dressing.

When the patient was readmitted to the hospital, on November 29, 1908, the fistulous tract was still open and as there was considerable purulent discharge, he was again operated on, December 3, by Dr. Stetten. At this operation about four and a half inches of three of the ribs were resected, in order to permit the rigid outer wall of the abscess cavity to collapse. In spite of this the discharge persisted, and although the greater part of the wound closed, a fistula remained which led to a cavity running upwards behind the ribs. Bismuth-vaseline mixture was injected into the cavity every second day, but there was no marked improvement. An X-ray plate showed that the cavity extended upwards to the fourth rib.

On March 27, 1909, the first stage of a thoracoplasty was

FIG. 1.

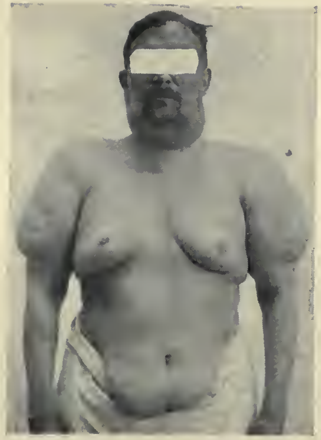


FIG. 2.

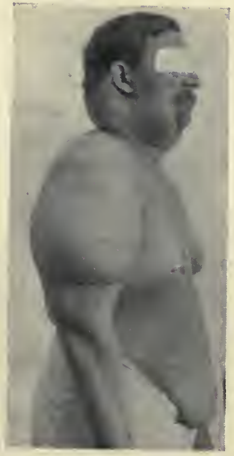
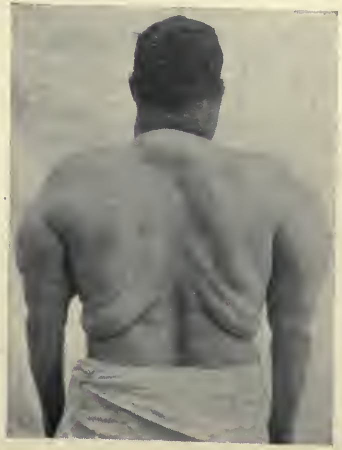


FIG. 3.



Multiple symmetrical lipomatosis.

done by Dr. Kiliani. The entire scapula was freed, and portions of the fourth, fifth, sixth, and seventh and about seven inches of the eighth ribs were resected. There was considerable bleeding following this procedure, which was controlled by tampons.

Six days later the second stage of the thoracoplasty was done. The anterior portions of the ribs previously resected were removed at the costochondral junction, and a more extensive resection of the upper ribs was done as high up as the fourth, until the entire cavity was laid bare. Its outer wall, which was half an inch in thickness, was removed entirely. Its inner wall, which rested on the lower lobe of the lung, was stripped off. There was considerable bleeding, which was checked by tamponades. As soon as the thick membrane was removed, the lung, which had been incarcerated by this pseudomembrane for two and a half years, immediately expanded, bulging out about four inches. The cavity was packed and the chest flap allowed to fall over, being sutured only at the angles. The patient made an excellent recovery, and now had very fair breathing capacity on the affected side.

Dr. Charles N. Dowd, speaking of Dr. Kiliani's case of thoracoplasty, said he had obtained the best and easiest exposure of the thoracic sinus by an incision carried upward at the anterior axillary line, cutting off as much from the cut ends of the ribs as was desirable, and removing a portion of the pulmonary pleura, and that the resulting deformity was less than after the Schede operation.

Referring to the expansion of the lung after freeing it, Dr. Dowd said that since the publication of Dr. Lloyd's article, some years ago, he had permitted his patients to come out of the anæsthetic after the incision was made and had allowed them to cough, and in almost every instance this produced expansion of the lung. Almost as much was gained, he thought, by allowing the patient to cough as by the use of an apparatus. He recalled one case where the patient developed a pneumonia in the expanded lung. While early expansion of the lung was of advantage, it had not, in his experience, greatly hastened the closure of the cavity very much over older methods of technic. He had successfully maintained negative chest pressure by means of Colton's apparatus, which was constructed on the principle of the Bunsen filter pump.

Dr. Kiliani said that in his case the lung had been incarcerated for two and a half years, and the thorax was tremendously thickened. It was at least two and a half inches in thickness, and its removal necessitated a very wide exposure.

Dr. Meyer, referring to the possibility of rendering the thoracoplasty wound air-tight, said the use of a rubber dam had been proposed which would allow the fluid to run out without giving access to air. The use of an apparatus with negative and positive pressure would probably go far to simplify the treatment of these cases, and perhaps save the occurrence of long-standing fistulous openings.

HOUR-GLASS STOMACH: GASTROGASTROSTOMY.

Dr. William A. Downes presented a woman, 33 years of age, whose case furnished the subject of a paper by him on Hour-glass Stomach, for which see page 552.

Dr. F. Kammerer said his experience with hour-glass stomach was limited to a few cases. One of them, which he had observed nineteen years ago, was a young girl of about 17 years, who was brought to the hospital in a condition of extreme emaciation. The patient died without operation, and the autopsy showed a narrowing just at the middle of the stomach, dividing that organ into two equal pouches. There were no evidences of any ulcers or cicatrices, and for that reason the case was regarded as one of congenital malformation at the time.

In another case, Dr. Kammerer did a gastroplasty and found it very easy to approximate the edges of the two pouches. This case has been referred to often in medical literature. Under such condition he considered gastroplasty preferable to gastrogastrostomy, because it left one large communication between the two pouches. When the cicatrices were very firm, it might be impossible to do a gastroplasty.

French surgeons have been much interested in the subject of hour-glass stomach lately and have contributed new methods for the treatment of this ailment, such as double gastro-enterostomy and resection of the stenosed portion of the stomach, as hour-glass stomach is so often complicated by a stenosis of the pylorus, the single operations, first referred to, are frequently insufficient.

Montprofit has strongly advised that in all cases in which a gastro-enterostomy was indicated, the anterior operation should be done, and not the posterior, and that a communication should be established between both pouches by the Y-shaped method. Dr. Kammerer said he was inclined to agree with the suggestion of this French writer in such cases.

Dr. Charles L. Gibson said that in the only case of hour-glass stomach that had come under his observation where he did a gastrogastrostomy the patient's nutrition was improved, but the operation failed to relieve the pain, and there was still occasional vomiting. The patient had refused further operation.

Dr. Charles A. Elsberg said that during the past six years he had seen two cases of hour-glass stomach, one following carcinoma, the second an ulcer. In the latter he did a posterior gastro-enterostomy, which gave the patient relief. In the first case he did a gastrogastrostomy, making the opening very large, which also gave relief. The opening left between the two pouches was very large and extended from the greater to the lesser curvature.

Dr. Joseph A. Blake said that one cause of failure of these operations was due to the common occurrence of stenosis of the pylorus in hour-glass contraction. A stomach which he saw removed from a child about a year ago, the supposed hour-glass stomach of congenital origin, proved to be atresia of the duodenum, with a widely dilated pylorus.

POSITIVE DIFFERENTIAL CHAMBER FOR INTRATHORACIC SURGERY.

Dr. Willy Meyer demonstrated his new positive differential chamber for intrathoracic operations, which had been erected in a temporary operating room, set aside for the time being for this kind of work at the German Hospital. The same chamber is used as the anæsthetizing room as a part of his "universal differential chamber," which, Dr. Meyer said, he is now testing at the Rockefeller Institute. He described its new constructive features and comparative advantages, laying special stress on the fact that it gives the operator sufficient elbow-room and room for a second assistant on his left side, permits of direct conversation between surgeon and narcotizer, offers opportunity for the surgeon to observe the patient's face and the transportability and therewith adaptability of the apparatus to the requirements of military surgery.

Dr. Meyer also demonstrated a new operating table which he had designed for intrathoracic work.

TRANSACTIONS

OF THE

PHILADELPHIA ACADEMY OF SURGERY.

Stated Meeting held May 3, 1909.

The President, Dr. William J. Taylor, in the Chair.

MULTIPLE FRACTURES, INVOLVING THE FACE BONES, THE LEFT ELBOW, AND BOTH FEMURS.

Dr. Astley Paston Cooper Ashhurst said that in a paper on Multiple Fractures, which he read before the Philadelphia Academy of Surgery in April, 1907 (Annals of Surgery, 1907, xlvi, 263) statistics were presented showing that multiple fractures form only about 1.44 per cent. of fractures in general, and that the mortality at the present day is at least 25 per cent., even when cases of crush of the extremities calling for immediate amputation and other cases dying in a few hours from shock are excluded. The mortality of fractures in general was found to be about 2.7 per cent., so that the outlook in a case of multiple fractures is just about ten times as gloomy as in ordinary cases. The case now reported, with the kind permission of Dr. Chas. H. Frazier, is one in which, in addition to numerous other fractures, both femurs were broken and could not be reduced without operation. Among the 73 cases of multiple fractures from the statistics of the Episcopal Hospital, reported in 1907, there were only two in which both femurs were fractured; both of these patients died. Among 121 recent fractures of the femur at the Episcopal Hospital, reported a year ago (Annals of Surgery, 1908, xlviii, 748) in collaboration with Dr. Wm. A. Newell, there was not one case in which operation had to be done. So that the present case is remarkable both for his recovery, and from the fact that operation was required on both femurs.

Frank R., a sailor, aged 26 years, was admitted to Dr. Frazier's service in the Episcopal Hospital at 7 p.m., December

5, 1908. While at work on a ship lying at the dock he had fallen a distance of fifty-five feet into the hold, landing on piles of copper ore.

Examination showed the following injuries: There was no vision in the left eye, the pupil being widely dilated, with hemorrhage into the anterior chamber, and dislocation of the lens. The left malar bone was broken near its articulation with the superior maxillary. Both the right and left superior maxillæ were fractured, the line of fracture crossing the median line of the alveolus. There was a comminuted fracture of the nasal bones. The inferior maxilla was broken in three separate places: (1) through the left ramus; (2) just to the left of the symphysis; (3) through the body on the right side. The left humerus presented a fracture of the external condyle; and there was a fracture of the head of the left radius, with dislocation, along with the fragment of the humerus. There was a comminuted fracture of the right femur into the knee-joint, the internal condyle with a fragment of the posterior surface of the external condyle being dislocated posteriorly along with the tibia and fibula, the patella being impacted between the fragments, and the external condyle jutting out and almost rupturing the skin, in the neighborhood of the head of the fibula; the skin, though much abraded and contused, was not broken. In addition to these injuries there was a compound comminuted fracture below the middle of the left femur, with rupture of the ligamentum patellæ, and a large hæmatoma over the seat of fracture.

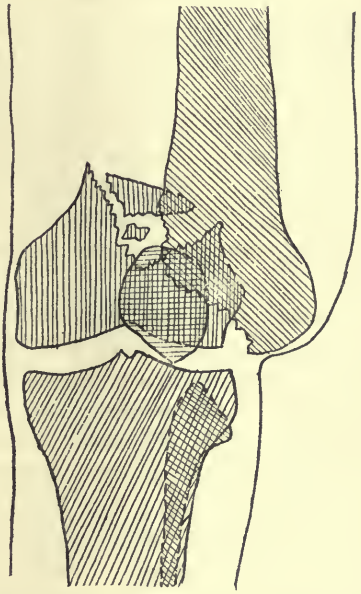
The man was in profound shock. His temperature on admission was 95.4° F. By midnight it had risen to 97.8° F., and the next morning reached normal. He was appropriately treated for the shock, and though death seemed imminent, dressings were applied to the various fractures. A chin-cap and Gibson bandage were applied to the face; the dislocation of the radius was reduced, and the elbow was dressed in acute flexion. Buck's extension and sand-bags were applied to each lower extremity. It was imposible to reduce the fracture-dislocation of the right knee; and no great force was used in attempting to set the left femur, as the condition of the soft parts (hæmatoma and wound of compound fracture) did not warrant it.

Contrary to expectation, the patient's general condition gradually improved; his temperature on the afternoon of the second day was 100.6° F., and this was the highest ever reached. The wound in the left thigh healed without becoming infected.

On December 11, six days after admission, Dr. Frazier attempted under ether to reduce the dislocation of the right knee, but was unable to do so. It seemed imperative to secure reduction, as the skin was stretched so tightly over the projecting external condyle that it was feared sloughing would soon occur. Accordingly, the next day Dr. Ashhurst operated for Dr. Frazier, as the patient, though still delirious, seemed able to stand a formal operation. In order to avoid the abraded and granulating skin, which was swabbed with iodine before beginning the operation, the joint was opened as for a fracture of the patella, by a curved incision, with convexity below (the ligamentum patellæ was not divided). This flap was turned up, and the external condyle was found projecting through the capsule of the joint, just beneath the skin. The capsule was therefore opened, but reduction was still impossible, as the patella was firmly fixed between the shaft of the femur, above the external condyle, on its outer side and the inner condyle on the inner side. The patella was rotated about 90 degrees on its longitudinal axis, so that its anterior surface looked outward (Fig. 1). To extract it, the rectus femoris had to be cut from the vastus externus, and then the patella could be pried out from behind the condyles, and the fracture reduced. As very good apposition of the fragments was obtained, no wires, screws, or plates were used to retain them. The quadriceps tendon was sutured again to the vastus externus, and the capsule was then closed, buried sutures of chromic gut being used in both instances. The skin wound was closed with interrupted sutures of chromic gut, and a small drain of plain catgut was left beneath the skin at the outer angle of the incision. This was of course absorbed in a few days, but served the purpose of temporary drainage into the dressings, and obviated the necessity of trapping the cast for its removal. Strict *asepsis* was used throughout the operation, which took thirty-five minutes. A Buck's extension was then applied, and over all the dressings a plaster cast, which extended from the toes to the groin. The entire operation was done while the patient was lying in his bed, as it was feared that removal to the operating table might injure his other femur. During this anæsthetization the patient's upper and lower jaws, which had begun to knit, were unavoidably refractured. The next day his temperature was normal, but on the second day it reached 100.6° F., and then again became normal. The cast was left on for over five weeks, and on removal (January 19, 1909) the patella was found movable, and the fragments firmly united and in excellent position. There were a few granulations at the outer angle of the wound, where it had been drained. Passive motion was then begun.

When four weeks had elapsed from the time of the accident, it was found that there was no union in the left femur, which had been the seat of a compound comminuted fracture; and as the skiagraph showed overlapping of about two inches, and as this could not be reduced by traction, it seemed proper to operate on this femur also.

FIG. 1



Tracing of skiagraph of right knee. Comminuted fracture through external condyle of femur, with posterior dislocation of tibia and lower fragment and impaction of patella between fragments.

Accordingly, on January 2, 1909, when substituting for Dr. G. G. Davis, and after consultation with Dr. Frazier, Dr. Ashhurst operated on the left femur, through an external incision of 8 inches, excising the callus which prevented reduction, and removing some loose fragments of the shaft. The upper fragment was anterior and inward, projecting into the rectus muscle. It was possible to secure very good apposition without resecting any of the femur, as the fracture was nearly transverse, and the comminution involved the inner surface only. A silver plate, with three screws in each fragment, was used to retain the bones. The wound was thoroughly washed out with hot bichloride, and was closed with two layers of buried sutures of chromic gut, which was also used for the skin sutures. A rubber drainage-tube was brought out through the lower angle of the wound, passing beneath the bone to the inner side of the line of fracture. The time of the operation was sixty-five minutes. A Buck's extension was applied, and over all a plaster cast from the toes to the groin. The drainage-tube was removed through a window in the cast on the second day. On the third day the temperature reached 100.6° F., and then again fell to normal. This cast was removed February 8, 1909, during the sixth week after operation. The position of the fragments was good, and fibrous union was present.

In March, the patient was about in a wheel chair, and motion in the knees was improving. Dr. Van Pelt took charge of the ocular condition, and sight gradually returned. Early in April the patient began to walk with crutches, and in two weeks time could walk with only one cane. He now walks without support of any kind. The right knee has slight lateral mobility in full extension, and for some time felt a little weak in walking. The left femur has bowed somewhat outward, but union is firm, and the silver plate is producing no irritation. The right lower extremity is only one-half a centimetre shorter than the left. Both knees have a range of motion through about 40 degrees—from full extension to about 140 degrees. The fractures of the face have healed with only slight deformity, the alignment of the teeth being perfect, and very little distortion of the features remaining. The left elbow has a range of motion from 40 to 140 degrees, full extension being impossible on account of thickening of the head of the radius. The ruptured left ligamentum patellæ gives no further trouble. The left eye can now be used for reading, and the patient declares it to be as good as his other eye; the pupil remains dilated.

RESECTION OF COLON FOR CANCER AND FOR TUBERCULOSIS.

Dr. John H. Gibbon delivered the annual oration before the Academy upon the above theme, for which see page 571.

SURGICAL ASPECTS OF HYPERTROPHIC ARTHRITIS.

Dr. George P. Muller read a paper with the above title, for which see page 630.

INSTRUMENTS FOR OPENING THE SKULL.

Dr. William W. Keen exhibited an apparatus, consisting of a brace with four bits, devised by Dr. W. H. Hudson of Montgomery, Alabama. The peculiarity of the first two (the smaller) bits is that one can penetrate through either a thick or thin skull as far as the dura and the bit will go no farther. The others are globular bits and they will penetrate, but they are provided with a slight button on the end so that when the entire thickness of the skull is penetrated, even if the middle meningeal be directly under the drill, it will be pushed off, provided it is not in either a narrow groove or in a foramen. If it is, of course any drill would cut it just exactly as the ordinary saw or chisel would. The advantage of these bits is that one can very quickly make four openings and then can add three more, intermediate openings if desired, and introduce from one to the other a Gigli saw or bite the bone between them by Devilbiss' or other forceps as desired, turning down a flap in a very few minutes.

In Dr. Keen's opinion these bits provide the best means yet devised for opening the skull, having the safety of the chisel and the speed of the saw.

CORRESPONDENCE.

INTESTINAL ANASTOMOSIS BY INVAGINATION.

Editor Annals of Surgery:

Would you permit me to describe one or two improvements, as the result of additional experience, to the method of performing intestinal anastomosis, an account of which you were kind enough to publish in the Annals for May. In two cases of excision of the cæcum for tuberculosis, after removal of the diseased segment, I inverted the edges of the orifice of the distal segment and closed with a "purse-string" suture, which much simplified and shortened the process of occlusion. And, further, I found that a "continuous" instead of an "interrupted" Lembert suture, for uniting the walls of the invaginated bowel to the margin of the incision into the paries of the distal segment, was easier and more rapid in execution.

I would like to add that one important postoperative procedure, which experience has taught this particular method of intestinal anastomosis admits, is that early feeding by the mouth may be indulged in; indeed, food may with perfect security be given as soon as the effect of the anæsthetic has passed off; and in cases of removal of portions of the bowel for tuberculosis or carcinoma this item in after-treatment is of no small moment.

Glasgow, May 24, 1909. A. Ernest Maylard.

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